TITLE Aviation Turbine Engine Diagnostic System (ATEDS) for the OH-58D Helicopter

AUTHOR Larry R. DeMott

COMPANY NAME Rolls-Royce Allison
COMPANY ADDRESS P.O. Box 420
Indianapolis, IN 46206

DATE July 1999

FINAL REPORT

19990805 060

DISTRIBUTION STATEMENT
Approved for Public Release
Distribution Unlimited

Prepared for

AVIATION RESEARCH, DEVELOPMENT & ENGINEERING CENTER (AMCOM)
AVIATION APPLIED TECHNOLOGY DIRECTORATE

DTIC QUALITY INSPECTED 2
**Title and Subtitle**

Aviation Turbine Engine Diagnostic System (ATEDS) for the OH-58D Helicopter

**Author(s)**

Larry R. DeMott

**Performing Organization Name(s) and Address(es)**

Rolls-Royce Allison
P.O. Box 420
Indianapolis, IN 46206-0420

**Sponsoring/Monitoring Agency Name(s) and Address(es)**

Aviation Applied Technology Directorate, Aviation Research, Development & Engineering Center (AMCOM)
Fort Eustis, VA 23604-5577

**Abstract**

The US Army has documented the need for improved equipment and procedures to provide electronic troubleshooting/diagnostics of helicopter turbine engines. The Aviation Turbine Engine Diagnostic System (ATEDS) development has been initiated to address this need. A key element of the system development requires the creation of detailed, step-by-step, troubleshooting/diagnostic procedures and conversion of this data to electronic format compatible with the overall system. This report documents the activity accomplished by Rolls-Royce Allison in developing this data for application to the OH-58D Kiowa Warrior helicopter.
Development and SGML-Tagging of Troubleshooting and Diagnostic Procedures for Rolls-Royce Allison T703-AD-700 and 250-C30R/3 Engines, and 250-C30R/3 FADEC

U.S. Army Contract DAAJ02-97-C-0014

Aviation Turbine Engine Diagnostic System (ATEDS)

19 July 1999
# Table of Contents

1.0 Foreword .................................................................................................................. 1

2.0 Objectives ................................................................................................................ 1
   2.1 Task I ..................................................................................................................... 1
   2.2 Task II .................................................................................................................. 1

3.0 Scope ......................................................................................................................... 2

4.0 Summary ................................................................................................................... 2

5.0 Recommendation ...................................................................................................... 2

6.0 Discussion .................................................................................................................. 2
   6.1 Development of Troubleshooting/Diagnostic Procedures .................................... 2
   6.2 Visio Flow Charts of Troubleshooting/Diagnostic Procedures ............................... 20
   6.3 Standard Generalized Markup Language (SGML) Tagged Data ............................. 20
   6.4 Specialized Test Equipment Required to Support Troubleshooting and Diagnosing ... 20

Appendix A  T703-AD-700 Fault Isolation and Correction Visio Charts ......................... A-1

Appendix B  Model 250-C30R/3 Basic Engine Fault Isolation and Correction Visio Charts . B-1

Appendix C  Model 250-C30R/3 FADEC Fault Isolation and Correction Visio Charts ....... C-1

Appendix D  SGML Tagged Data .................................................................................. D-1

Appendix E  Test Equipment Required to Perform Troubleshooting/Diagnostic Tasks .... E-1
List of Tables

Table I.  List of faults for which isolation and correction procedures were developed:
T703-AD-700 engine .................................................................................................................. 3

Table II. List of faults for which isolation and correction procedures were developed:
Model 250-C30R/3 basic engine .................................................................................................. 9

Table III. List of faults for which isolation and correction procedures were developed:
Model 250-C30R/3 FADEC ......................................................................................................... 13
1.0 Foreword

The U.S. Army is currently using old test equipment and incomplete troubleshooting procedures to diagnose engine and engine-to-airframe faults on OH-58D Kiowa helicopters. Mechanics often replace numerous components, without adequate troubleshooting, until the fault is corrected. The practice is expensive, creates a burden on the logistics system, and adversely affects aircraft readiness.

The U.S. Army Aviation Center has documented the need for improved equipment and procedures to provide electronic troubleshooting/diagnostics of helicopter turbine engines, and has initiated development of an Aviation Turbine Engine Diagnostic System (ATEDS) to address this situation. ATEDS will be comprised of portable computers containing interactive software for troubleshooting and diagnosing engine and engine-to-aircraft interface problems, with links to electronic technical manuals (and, eventually, to flight data recorders and automated log books), and specialized test equipment to support the troubleshooting/diagnostic procedures.

As part of the effort to develop the ATEDS, Rolls-Royce Allison was awarded a contract (DAAJ02-97-C-0014) to generate the detailed, step-by-step, troubleshooting/diagnostic procedures and identify the specialized test equipment necessary to allow the maintainer to perform the troubleshooting/diagnostics procedures. This report addresses activities related to this system.

2.0 Objectives

The objectives of the contracted effort to which this report is directed are as defined under Tasks I and II of the Statement of Work, as follows.

2.1 Task I

The contractor shall develop the electronic Standard Generalized Markup Language (SGML) tagged datafiles of troubleshooting/diagnostic procedures for engine and engine-to-airframe interface faults (mechanical and electrical). Engine-to-airframe interface shall refer the maintainer to the procedures and appropriate manual necessary to simulate engine input/outputs to verify operation of airframe instrumentation and the procedures to verify proper engine-to-airframe mechanical/electrical interfaces. The troubleshooting/diagnostic procedures shall be limited to Aviation Unit Maintenance (AVUM) and Aviation Unit Intermediate Maintenance (AVIM) repairs. The procedures shall meet the performance requirements in Appendix A, and cover the following engines and associated airframes.

<table>
<thead>
<tr>
<th>Engine</th>
<th>Airframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>250-C30R/3</td>
<td>OH-58D</td>
</tr>
<tr>
<td>T703-AD-700</td>
<td>OH-58D</td>
</tr>
</tbody>
</table>

2.2 Task II

The contractor shall attend a kickoff meeting at the Aviation Applied Technology Directorate, Fort Eustis, Virginia. The purpose of the meeting is to define a common user interface, among the Army’s engine manufacturers, for the electronic troubleshooting/diagnostic procedures. The kickoff meeting shall be held within 30 days after contract award.
3.0 Scope

This report is submitted in fulfillment of requirements of Aviation Turbine Engine Diagnostic System (ATEDS) Contract DAAJ02-97-C-0014, CDRL Items A003, Technical Report (Draft), and A004, Technical Report (Final).

4.0 Summary

Troubleshooting/diagnostic procedures were developed for a total of 159 observed or indicated faults, in the following three categories:

- T703-AD-700 engine
- 250-C30R/3 basic engine (less control system)
- 250-C30R/3 Full Authority Digital Electronic Control System (FADEC)

Each troubleshooting/diagnostic procedure was developed in flow chart format and graphically depicted using Visio 4.0 software. SGML tagging was based on text and logic contained in the Visio flow charts.

The various actions to be performed on the engine and airframe in pursuance of the troubleshooting/diagnostic procedures were, where available, referenced to the corresponding tasks in the engine and/or airframe technical manuals.

Items of specialized test equipment required to perform the various diagnostic procedures were identified.

5.0 Recommendation

It is recommended that this report be accepted as fulfilling the requirements of Aviation Turbine Engine Diagnostic System (ATEDS) Contract DAAJ02-97-C-0014, CDRL Items A003, Technical Report (Draft), and A004, Technical Report (Final).

6.0 Discussion

6.1 Development of Troubleshooting/Diagnostic Procedures

The following three separate sets of troubleshooting/diagnostic procedures were developed:

- T703-AD-700 engine (with supervisory electronic control system) and engine-to-aircraft interfaces
- 250-C30R/3 engine (except for control system) and engine-to-aircraft interfaces
- 250-C30R/3 Full Authority Digital Control System (FADEC) and FADEC-to-aircraft interfaces

For each of these categories, a set of observable or detectable symptoms was established and possible causes defined. A fault isolation/correction procedure was then developed for each symptom, considering all of the defined possible causes. The symptoms and the possible causes are presented in the following tables:

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of procedures</th>
<th>Table No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1.1 T703-AD-700 engine</td>
<td>51</td>
<td>I</td>
</tr>
<tr>
<td>6.1.2 250-C30R/3 basic engine</td>
<td>51</td>
<td>II</td>
</tr>
<tr>
<td>6.1.3 250-C30R/3 FADEC</td>
<td>57</td>
<td>III</td>
</tr>
</tbody>
</table>
Table I. List of faults for which isolation and correction procedures were developed: T703-AD-700 engine.

<table>
<thead>
<tr>
<th>Item*</th>
<th>Symptom</th>
<th>Possible causes or sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-1</td>
<td>Starter unable to motor engine to fuel introduction speed</td>
<td>Low battery. Degraded starter. GG rotor rub or drag. Inlet or exhaust blockage</td>
</tr>
<tr>
<td>ST-3</td>
<td>Engine lights off prior to reaching fuel introduction speed. (Premature light off).</td>
<td>Fuel control cut off valve not closed. Combustor drain valve stuck closed</td>
</tr>
<tr>
<td>ST-4</td>
<td>Engine lights off normally but acceleration rate is slow with low TGT. May stagnate (hang) at around 30% Ng</td>
<td>Restricted fuel supply. Anti-icing or accessory bleed air on or leaking. Pneumatic leak in fuel control air sensing tubes or accumulators. Fuel control schedule shifted low. Electronic supervisory control. Excessive compressor air leakage. Low inlet fuel pressure at fuel pump. Fuel nozzle. Compressor erosion or damage.</td>
</tr>
<tr>
<td>ST-7</td>
<td>Engine accelerates to overspeed during start.</td>
<td>Fuel control throttle rigging. Frosting or icing in the fuel control Py governing orifice. Fuel control failure</td>
</tr>
<tr>
<td>ST-8</td>
<td>Engine lights off but flames out during ground starts at high altitude, especially above 5,000 ft (1542 meters) at cool temperatures,</td>
<td>Incorrect fuel type. Fuel nozzle coking. Combustor. Outer combustion case. GGT first stage nozzle shield.</td>
</tr>
<tr>
<td>ST-10</td>
<td>Main rotor (and Np) do not rotate by 25% Ng speed during start</td>
<td>Improper oil type in cold weather. Excess drag in aircraft drive train. Accessory gearbox internal fault.</td>
</tr>
<tr>
<td>Item</td>
<td>Symptom</td>
<td>Possible causes or sources</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ST-12</td>
<td>No oil pressure indication during start</td>
<td>Oil pump not properly primed. Restriction in oil pump supply line. Low oil level in tank. Dirty oil filter. Faulty aircraft oil pressure sensor or indicator. Leaks within the oil filter housing. Oil pressure regulator sticking. Oil pump or oil pump drive failure. Accessory gearbox problem.</td>
</tr>
<tr>
<td>RG-1</td>
<td>Engine speed cycles (unstable) at ground idle (61-65% Ng).</td>
<td>Fuel control throttle rigging and/or security. Restriction in fuel supply. Aircraft electrical harness. Fuel control air sensing tube leak or fuel control malfunction. Electronic supervisory control. Compressor bleed control valve</td>
</tr>
<tr>
<td>RG-3</td>
<td>Idle speed does not repeat to the desired set point on repeated throttle movements from, and returning to, idle.</td>
<td>Fuel control throttle rigging or security. Fuel control malfunction. Electronic supervisory control.</td>
</tr>
<tr>
<td>RG-4</td>
<td>Idle speed too low. (shifted low from prior setting).</td>
<td>Incorrect fuel control throttle lever setting or idle speed adjustment incorrectly set. Ng tachometer error. Excessive generator load (will result in slightly higher than normal TGT)- Fuel control malfunction. Electronic supervisory control.</td>
</tr>
<tr>
<td>RG-5</td>
<td>Idle speed too high. Will not respond to idle speed decrease adjustment. May respond to gross idle speed increase adjustment.</td>
<td>Fuel control throttle lever setting or idle speed adjustment incorrectly set. Ng tachometer error. Fuel control malfunction. Electronic supervisory control.</td>
</tr>
<tr>
<td>RG-6</td>
<td>Fuel and/or oil leaking from fuel pump/fuel control overboard drain port.</td>
<td>Fuel pump drive shaft seal leaking. Gearbox seal leaking.</td>
</tr>
<tr>
<td>RG-7</td>
<td>Oil emanating from diffuser vent orifice.</td>
<td>Orifice improperly sized.</td>
</tr>
<tr>
<td>RG-8</td>
<td>Unable to stop engine with fuel control throttle movement to cut off.</td>
<td>Fuel control cut off valve not properly closing. Fuel control throttle rigging or security.</td>
</tr>
<tr>
<td>RG-9</td>
<td>Oil leaking from accessory gearbox drive(s).</td>
<td>There are ten output drive pads on the accessory gearbox, front and rear. Leakage from any of these, except the AGB breather gear shaft seal, can be repaired by replacement of the seal without engine removal.</td>
</tr>
<tr>
<td>Item</td>
<td>Symptom</td>
<td>Possible causes or sources</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>RGF-2</td>
<td>Compressor surges during acceleration from idle to governing at 100% Np/Nr.</td>
<td>Compressor damage or degradation. Compressor inlet blockage. Pressure or thermal distortion. Bleed valve closing too soon or stuck closed GG turbine 1st stage nozzle area reduced by blockage from ingested sand and dust deposits. Fuel control malfunction. Electronic supervisory control.</td>
</tr>
<tr>
<td>RGF-3</td>
<td>Excessive vibration</td>
<td>Engine mount looseness. Engine alignment. Main rotor or tail rotor drive systems. Damage or failure of compressor rotor, GGT, or PT rotor. Main or AGB bearings, GG or PT rotor unbalance. Accessory unbalance. Gear failure. Gear tooth match.</td>
</tr>
<tr>
<td>RGF-9</td>
<td>Faulty torquemeter indication.</td>
<td>Torquemeter bleed clogged. Torquemeter pressure sensing oil line clogged. Torque measurement system. Torque transducer or related wiring faulty. Torquemeter supporting bearing failure. Low main oil pressure</td>
</tr>
<tr>
<td>RGF-10</td>
<td>Continuous exhaust smoking.</td>
<td>Restricted power turbine sump scavenger strut or scavenger piping. Degraded oil pump. No. 5 seal leak. No.1 seal leak. Failed No. 5 bearing. Defective turbine seal. AGB breather gear lip seal. Oil transfer tubes. Aircraft scavenging system.</td>
</tr>
<tr>
<td>RGF-11</td>
<td>Oil seeping or leaking from gearbox vent and/or tubing joints.</td>
<td>AGB breather gearshaft lip seal leakage. High gearbox pressure caused by diffuser vent orifice too small or damaged. Worn or damaged turbine seals in the cooling air or pressure balance circuits.</td>
</tr>
<tr>
<td>RGF-13</td>
<td>High oil pressure.</td>
<td>Oil pressure measurement system. Oil passage obstruction in AGB. Turbine oil supply restriction.</td>
</tr>
<tr>
<td>Item</td>
<td>Symptom</td>
<td>Possible causes or sources</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>RGF-14</td>
<td>Oil pressure drops off severely with normal oil temperature.</td>
<td>Oil level. Pressure measurement system. Oil pressure regulator. Degraded oil pump. Oil transfer tubes. Aircraft oil system flow restriction. Oil foaming.</td>
</tr>
<tr>
<td>RGF-15</td>
<td>Oil temperature exceeds 107° C (225 °F)</td>
<td>Oil temperature measurement system. Aircraft oil cooler. Cooler bypass, or thermostat. Cooling fan damaged or obstructed.</td>
</tr>
<tr>
<td>RGF-16</td>
<td>Excessive oil pressure fluctuation.</td>
<td>Oil level. Pressure measurement system. Oil pressure regulator. Air in pressure sense line. Oil foaming. Aircraft oil system flow restriction. Oil pump.</td>
</tr>
<tr>
<td>RGF-17</td>
<td>Engine oil tank fills during flight as transmission oil level decreases.</td>
<td>Oil transferring through leaking seals at the front and/or rear AGB power output drives.</td>
</tr>
<tr>
<td>RGF-18</td>
<td>Transmission oil level increases during flight as engine oil tank empties.</td>
<td>Oil leaking, or being forced, through seals at the front and/or rear AGB power output drives.</td>
</tr>
<tr>
<td>RF-1</td>
<td>Low power with high TGT.</td>
<td>Ng, Torque, or Np measuring systems. Dirty or degraded/damaged compressor. Degraded turbine. Blocked or distorted inlet. Blocked exhaust. Anti icing system on or leaking. External air leaks. Accessory bleed open. Degraded combustor. No 6 and 7 area labyrinth seals having excessive clearance.</td>
</tr>
<tr>
<td>RF-3</td>
<td>Low measured TGT at normal or high power.</td>
<td>TGT Indicator, thermocouple, or harness. Engine electrical harness. Aircraft electrical harness. NOTE: IF THE ENGINE IS PRODUCING NORMAL POWER, THE FUEL CONTROL SYSTEM CANNOT CAUSE A TGT ERROR.</td>
</tr>
<tr>
<td>RF-5</td>
<td>Oil consumption exceeds one quart per five hours of engine operation.</td>
<td>External leak, engine or aircraft. AGB lip seal leak. No. 1 seal leak. Turbine sump scavenge strut blockage or inadequate scavenging. High AGB case labyrinth seal leak. Dirty scavenge filter.</td>
</tr>
<tr>
<td>OFF-1</td>
<td>Bearing noise at compressor which may be accompanied by looseness of the impeller.</td>
<td>This is an indication of a bearing failure.</td>
</tr>
<tr>
<td>OFF-2</td>
<td>Engine will not crank. (Started unable to rotate engine).</td>
<td>Electrically failed or defective starter. Binding of compressor, turbine or gearbox.</td>
</tr>
</tbody>
</table>
### Table 1 (cont)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symptom</th>
<th>Possible causes or sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF-3</td>
<td>Starter will not rotate engine immediately after shutdown.</td>
<td>Binding of rotating components due to differential rate of cooling, or insufficient clearance.</td>
</tr>
<tr>
<td>OFF-4</td>
<td>Static oil leakage from power and accessory gearbox breather.</td>
<td>This is an indication that the oil filter check valve is leaking.</td>
</tr>
<tr>
<td>OFF-5</td>
<td>Fuel leaking from fuel control seep holes. Leakage may be blue in color and/or blue stain may be found on the lower external surface of the fuel control.</td>
<td>Fuel pump seal leak or fuel pump O-ring leaking.</td>
</tr>
<tr>
<td>OFF-6</td>
<td>Afterfire, TGT increase after shutdown indicating residual fire in the combustor</td>
<td>Fuel control cut off valve not fully closed. Oil leak. Sticking combustor drain valve. Combustor drain valve line obstruction.</td>
</tr>
<tr>
<td>OFF-7</td>
<td>Exhaust smoking during or immediately following engine shutdown. (Light wisps of smoke can be normal and are not cause for maintenance action unless oil consumption limits are exceeded).</td>
<td>Exhaust collector drain restricted. Combustor drain restricted. Blocked power turbine scavenge strut. Aircraft system scavenge flow restricted. Scavenge flow from turbine restricted. Defective turbine seals. Leaking oil transfer tubes or check valve. Defective oil pump.</td>
</tr>
</tbody>
</table>

* Item number code letters indicate engine operating regime to which corresponding symptom applies, as follows:

<table>
<thead>
<tr>
<th>CODE</th>
<th>operating regime</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-</td>
<td>engine starting</td>
</tr>
<tr>
<td>RG-</td>
<td>engine running, on ground</td>
</tr>
<tr>
<td>RGF-</td>
<td>engine running, on ground or in flight</td>
</tr>
<tr>
<td>RF-</td>
<td>engine running, in flight</td>
</tr>
<tr>
<td>OFF-</td>
<td>engine shut down, not running</td>
</tr>
</tbody>
</table>
This page intentionally blank.
Table II. List of faults for which isolation and correction procedures were developed: 250-C30R/3 basic engine.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Operating regime</th>
<th>Fault description</th>
<th>Possible causes or sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>St-2</td>
<td>Start</td>
<td>Compressor surges during starts</td>
<td>ECU/HMU/inducer bleed duct restriction/inlet blockage/thermal distortion/compressor, damage or erosion/turbine blockage</td>
</tr>
<tr>
<td>St-3</td>
<td>Start</td>
<td>Flames out after light-off during start attempts at high altitude/cold ambient conditions</td>
<td>Fuel type/fuel nozzle coking/fuel nozzle immersion depth/combustion system</td>
</tr>
<tr>
<td>St-4</td>
<td>Start</td>
<td>Rich/delayed light-off</td>
<td>Intermittent (or faulty) ignition/fuel nozzle spray pattern/fuel nozzle flow divider/ECU/HMU/burner drain valve/external or internal lube check valve</td>
</tr>
<tr>
<td>St-5</td>
<td>Start</td>
<td>Motors to required speed but does not light off</td>
<td>Fuel supply/water in fuel/ignition/HMU rigging/fuel nozzle shimming/fuel nozzle coking/fuel nozzle flow divider valve stuck/combustor/outer combustion case/GGT 1st stage nozzle shield/HMU/ECU</td>
</tr>
<tr>
<td>St-6</td>
<td>Start</td>
<td>Lights off prior to scheduled fuel introduction speed</td>
<td>ECU/HMU/burner drain valve/HMU fuel valve leakage</td>
</tr>
<tr>
<td>St-7</td>
<td>Start</td>
<td>Lights off but will not accelerate to idle at normal rate</td>
<td>Fuel supply/compressor damage or erosion/low battery power/degraded starter/fuel nozzle tip carbon or flow divider/anti-icing or accessory bleed air on or air leaks/ECU/HMU</td>
</tr>
<tr>
<td>St-8</td>
<td>Start</td>
<td>MGT too high during start</td>
<td>Residual fuel in combustor/high residual MGT/low battery power/degraded starter/fuel nozzle flow divider valve stuck/excessive compressor air bleed or leakage/ECU/HMU</td>
</tr>
<tr>
<td>St-9</td>
<td>Start</td>
<td>MGT too low during start</td>
<td>ECU/HMU/MGT harness/MGT indicator calibration/engine electrical harness/engine accessory harness</td>
</tr>
<tr>
<td>St-10</td>
<td>Start</td>
<td>No oil pressure indicated during start</td>
<td>Low oil supply/oil pump not primed/oil filter element dirty/internal oil transfer tubes worn or leaking/oil supply restriction/oil pressure sensor or indicator calibration/oil pressure regulating valve stuck/failed oil pump or AGB</td>
</tr>
<tr>
<td>St-11</td>
<td>Start</td>
<td>No rotation of Nr/Np by 25% Ng during start</td>
<td>Helicopter rotor system drag/power turbine rotor system drag or lock-up/accessory gearbox power train drag or lock-up/wrong oil in cold environments</td>
</tr>
<tr>
<td>St-12</td>
<td>Start</td>
<td>Does not motor to required light-off speed</td>
<td>Low battery/degraded starter/internal oil transfer tubes or check valve leaking, causing AGB fill-up/gas generator rotor rub or drag/aircraft starter electrical circuits</td>
</tr>
<tr>
<td>St-13</td>
<td>Start</td>
<td>Starter will not rotate engine</td>
<td>Starter mechanically failed or defective/no voltage to starter/compressor rotor drag/gas generator turbine rotor drag/gas generator rotor frozen by ice/accessory gearbox failure</td>
</tr>
<tr>
<td>Item No.</td>
<td>Operating regime</td>
<td>Fault description</td>
<td>Possible causes or sources</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
<td>-------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>R-1</td>
<td>Run</td>
<td>Anti-icing system not operating properly</td>
<td>Electrical power/pilot valve/pilot valve vent/anti-icing air valve/valve-to-scroll gasket/anti-icing air supply tube/air tube from pilot valve to anti-icing valve/dirt in inlet guide vane exit slots</td>
</tr>
<tr>
<td>R-2</td>
<td>Run</td>
<td>Compressor surge/stall</td>
<td>ECU/HMU/compressor damage/compressor inlet blockage, pressure or thermal distortion/inducer bleed duct loose or restricted</td>
</tr>
<tr>
<td>R-3</td>
<td>Run</td>
<td>Exhaust duct emitting sparks</td>
<td>Fuel nozzle spray pattern/combustor burning or carbon/turbine/compressor rub, bearing failure, ingestion damage</td>
</tr>
<tr>
<td>R-4</td>
<td>Run</td>
<td>Exhaust torching during transients</td>
<td>ECU/HMU/fuel nozzle/external air leaks/cabin heater air leaks/anti-icing system air leaks</td>
</tr>
<tr>
<td>R-5</td>
<td>Run</td>
<td>Fuel leaking from HMU overboard drain port</td>
<td>HMU seal leak</td>
</tr>
<tr>
<td>R-6</td>
<td>Run</td>
<td>Ground idle speed too high or too low</td>
<td>ECU/HMU/power lever rigging/cockpit speed indication</td>
</tr>
<tr>
<td>R-7</td>
<td>Run</td>
<td>Magnetic chip detector warning</td>
<td>Chips/slivers/fuzz/accessory harness/aircraft wiring</td>
</tr>
<tr>
<td>R-8</td>
<td>Run</td>
<td>Low measured MGT at normal or high power</td>
<td>MGT harness/accessory harness/engine electrical harness/aircraft wiring/MGT indicator</td>
</tr>
<tr>
<td>R-9</td>
<td>Run</td>
<td>Ng or Np overspeed</td>
<td>Speed measurement systems/extreme maneuver/output load loss</td>
</tr>
<tr>
<td>R-10</td>
<td>Run</td>
<td>Ng or Np speed not indicating</td>
<td>Speed pick-up/speed indicator/engine electrical harness/engine-ECU interface harness/ECU to speed indicator aircraft wiring</td>
</tr>
<tr>
<td>R-11</td>
<td>Run</td>
<td>Oil consumption high (exceeding 1 quart per 5 hours engine operation)</td>
<td>External leak - engine or aircraft/AGB lip seal leaks/No. 1 seal leak/turbine sump scavenge strut blockage or inadequate scavenging/high AGB case pressure /No. 5 laby seal leak</td>
</tr>
<tr>
<td>R-12</td>
<td>Run</td>
<td>Oil leaking from accessory gearbox drive(s)</td>
<td>Drive pad lip seal/wet spline driveshaft seal</td>
</tr>
<tr>
<td>R-13</td>
<td>Run</td>
<td>Oil pressure drops off severely with normal oil temperature</td>
<td>Oil level/pressure measurement system/oil pressure regulator/degraded oil pump/oil transfer tubes/helicopter oil system flow restrictions/oil foaming</td>
</tr>
<tr>
<td>R-14</td>
<td>Run</td>
<td>Oil pressure fluctuates</td>
<td>Oil level/pressure measurement system/oil pressure regulator/air in pressure sense line/oil foaming/helicopter oil system flow restrictions/oil pump</td>
</tr>
<tr>
<td>R-15</td>
<td>Run</td>
<td>Oil pressure too high</td>
<td>Oil pressure measurement system/oil passage obstruction in AGB/turbine oil supply restriction</td>
</tr>
<tr>
<td>R-16</td>
<td>Run</td>
<td>Oil pressure too low</td>
<td>Oil level/oil pressure measurement system/oil pressure regulator/engine oil filter/oil transfer tube/external leak/oil supply restriction/high oil temperature</td>
</tr>
<tr>
<td>Item No.</td>
<td>Operating regime</td>
<td>Fault description</td>
<td>Possible causes or sources</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
<td>-------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>R-17</td>
<td>Run</td>
<td>Engine oil tank fills during flight as aircraft transmission oil level decreases</td>
<td>PTO lip seal/aircraft overrunning clutch scavenge pump</td>
</tr>
<tr>
<td>R-18</td>
<td>Run</td>
<td>Aircraft transmission oil level increases during flight as engine oil tank empties</td>
<td>PTO lip seal/AGB case pressure (compressor seal vent pressure, turbine inner balance piston seal)/damaged lip seal land on PTO gearshaft</td>
</tr>
<tr>
<td>R-19</td>
<td>Run</td>
<td>Oil spewing or seeping from diffuser vent orifice and tubing joints</td>
<td>Compressor seal vent pressure set too low/bent or distorted tube flanges</td>
</tr>
<tr>
<td>R-20</td>
<td>Run</td>
<td>Oil spewing or seeping from gearbox vent and tubing joints</td>
<td>AGB air-oil separator gear lip seal/high AGB case pressure from compressor seal vent pressure set too high, or turbine inner balance piston seal wear or damage/bent or distorted tube flange</td>
</tr>
<tr>
<td>R-21</td>
<td>Run</td>
<td>Oil temperature exceeds 107° C (225°F)</td>
<td>Oil temperature measurement system/helicopter oil cooler, cooler bypass, or thermostat/cooling fan damaged or obstructed</td>
</tr>
<tr>
<td>R-22</td>
<td>Run</td>
<td>Power low with high MGT</td>
<td>Torque or MGT measurement systems/dirty compressor/damaged or degraded compressor or turbine/blacked or distorted compressor inlet/compressor inducer bleed blocked/anti-icing system on/external air leaks/accessory bleed open/degraded combustor</td>
</tr>
<tr>
<td>R-23</td>
<td>Run</td>
<td>Power low with MGT below maximum limit</td>
<td>Power lever rigging/collective pitch-to-rotor rigging/fuel restriction, low fuel inlet pressure, dirty fuel filter/ECU/HMU</td>
</tr>
<tr>
<td>R-24</td>
<td>Run</td>
<td>Slow acceleration/NP droop</td>
<td>Collective pitch potentiometer rigging or fault</td>
</tr>
<tr>
<td>R-25</td>
<td>Run</td>
<td>Smoking during steady state operation</td>
<td>Restricted power turbine sump scavenge strut or scavenge piping/degraded oil pump/No. 5 laby seal/AGB breather gear lip seal/oil transfer tubes/No. 1 bearing or oil seal/aircraft scavenging system/worn turbine seals</td>
</tr>
<tr>
<td>R-26</td>
<td>Run</td>
<td>Smoking during transients</td>
<td>Restricted power turbine sump scavenge strut or scavenge piping/degraded oil pump/No. 5 laby seal/AGB breather gear lip seal/oil transfer tubes/worn turbine seals</td>
</tr>
<tr>
<td>R-27</td>
<td>Run</td>
<td>Faulty torquemeter indication</td>
<td>Cockpit torque measurement system/engine torquemeter/engine torquemeter transducer or related wiring/obstruction in oil tube from engine to transducers/low main oil pressure/ECU</td>
</tr>
<tr>
<td>R-28</td>
<td>Run</td>
<td>Unstable in power turbine governing (95%–105% Np)</td>
<td>ECU/HMU/power lever rigging and security/collective pitch position potentiometer/Np beeper switch/fuel supply restriction/engine, accessory, interface, or aircraft electrical harness</td>
</tr>
<tr>
<td>Item No.</td>
<td>Operating regime</td>
<td>Fault description</td>
<td>Possible causes or sources</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
<td>-------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>R-29</td>
<td>Run</td>
<td>Unstable at ground idle</td>
<td>ECU/HMU/power lever rigging and security/fuel supply restriction/engine, accessory, interface, or aircraft electrical harness/Ng speed measuring system</td>
</tr>
<tr>
<td>R-30</td>
<td>Run</td>
<td>Vibration excessive</td>
<td>Mount looseness/engine alignment/helicopter drive system/damage or failure of compressor rotor, GGT or PT rotor/main or AGB bearing(s)/GG or PT rotor unbalance/accessory unbalance/gear failure/gear tooth mesh</td>
</tr>
<tr>
<td>Sd-1</td>
<td>Shutdown</td>
<td>Afterfire (rising MGT after shutdown)</td>
<td>HMU/power lever rigging/burner drain valve/turbine internal oil leak</td>
</tr>
<tr>
<td>Sd-2</td>
<td>Shutdown</td>
<td>Compressor bearing noise or loose compressor rotor</td>
<td>Front compressor bearing/rear compressor bearing</td>
</tr>
<tr>
<td>Sd-3</td>
<td>Shutdown</td>
<td>Smoking during shutdown</td>
<td>Exhaust collector drain/leaking No. 5 laby seal/AGB air-oil separator gear lip seal/oil transfer tubes/oil check valve to turbines/burner drain valve/restricted scavenge to turbine sumps/defective turbine seals/oil pump/restricted aircraft oil system</td>
</tr>
<tr>
<td>Sd-4</td>
<td>Shutdown</td>
<td>Unable to stop engine with twist grip</td>
<td>HMU/power lever rigging/aircraft throttle linkage</td>
</tr>
<tr>
<td>Off-1</td>
<td>Off</td>
<td>Filter (engine fuel) impending bypass indicator extended</td>
<td>Dirty filter element/ contaminated fuel system/faulty pop-out</td>
</tr>
<tr>
<td>Off-2</td>
<td>Off</td>
<td>Filter (main oil) impending bypass indicator extended</td>
<td>Dirty filter element/contaminated oil/faulty pop-out</td>
</tr>
<tr>
<td>Off-3</td>
<td>Off</td>
<td>Oil reservoir level lowering with engine inoperative</td>
<td>Internal oil check valve/oil transfer tube leaks at oil filter housing/other internal AGB oil leaks or scavenge pump problems/aircraft system restrictions</td>
</tr>
<tr>
<td>Off-4</td>
<td>Off</td>
<td>Oil runs from burner drain valve after shutdown</td>
<td>Internal oil check valve/external oil check valve</td>
</tr>
<tr>
<td>Off-5</td>
<td>Off</td>
<td>Starter will not rotate engine immediately after shutdown</td>
<td>Turbine blade tip rub/compressor rub/AGB GG gear train failure</td>
</tr>
<tr>
<td>Item No.</td>
<td>FADEC fault category</td>
<td>Maintenance terminal fault code</td>
<td>Fault description</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>STEPPER MOTOR CIRCUIT FAULT</td>
<td>SmFlt</td>
<td>Stepper motor fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SmPhAVFlt</td>
<td>Stepper motor phase A voltage fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SmPhBVFlt</td>
<td>Stepper motor phase B voltage fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SmPhCVFlt</td>
<td>Stepper motor phase C voltage fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SmPhDVFlt</td>
<td>Stepper motor phase D voltage fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SmPhFlt</td>
<td>Stepper motor phase current fault</td>
</tr>
<tr>
<td>2</td>
<td>HOT START ABORT SOLENOID CIRCUIT FAULT</td>
<td>StSFlt</td>
<td>Start solenoid V bit fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>StSFlt</td>
<td>Start solenoid current fault</td>
</tr>
<tr>
<td>3</td>
<td>AUTO/MANUAL CHANGEOVER SOLENOID CIRCUIT FAULT</td>
<td>AMIFlt</td>
<td>Auto/Manual solenoid BIT current fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AMIFlt</td>
<td>Auto/Manual mode solenoid fault</td>
</tr>
<tr>
<td>4</td>
<td>OVERSPEED SYSTEM POWER-UP SELF TEST FAULT</td>
<td>OSIT2Flt</td>
<td>Overspeed BIT current fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSIT2Flt</td>
<td>Overspeed test 1 failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSIT2Flt</td>
<td>Overspeed test 2 failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSIT2Flt</td>
<td>Overspeed test 3 failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSIT2Flt</td>
<td>Overspeed test 4 failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSIT2Flt</td>
<td>Overspeed test 5 failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSIT2Flt</td>
<td>Overspeed test 6 failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSIT2Flt</td>
<td>Overspeed test 7 failed</td>
</tr>
<tr>
<td>5</td>
<td>METERING VALVE POSITION POTENTIOMETER CIRCUIT FAULT</td>
<td>WfmvFlt</td>
<td>Fuel metering valve fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WfmvFlt</td>
<td>Fuel metering valve range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WfmvFlt</td>
<td>Fuel metering valve rate fault</td>
</tr>
<tr>
<td>6</td>
<td>POWER LEVER ANGLE (THROTTLE POSITION) POTENTIOMETER CIRCUIT FAULT</td>
<td>PLA12Flt</td>
<td>PLA hard fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLA1Flt</td>
<td>PLA1 potentiometer input fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLA1RgFlt</td>
<td>PLA1 range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLA2Flt</td>
<td>PLA2 potentiometer input fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLA2RgFlt</td>
<td>PLA2 range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLA2Flt</td>
<td>(PLA1Raw-PLA2Raw) difference fault</td>
</tr>
<tr>
<td>Item No.</td>
<td>FADEC fault category</td>
<td>Maintenance terminal fault code</td>
<td>Fault description</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------</td>
<td>----------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>6 (cont.)</td>
<td>PLA POTENTIALMETER CIRCUIT FAULT (CONT.)</td>
<td>PLAhdFlt</td>
<td>PLA hard fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLARlFlt</td>
<td>PLA reference voltage fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLARIgFlt</td>
<td>PLA reference voltage range fault</td>
</tr>
<tr>
<td>7</td>
<td>CIT (T1) TEMPERATURE SENSOR CIRCUIT FAULT</td>
<td>T1ABFlt</td>
<td>T1 hard fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1AFlt</td>
<td>T1A fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1ARgFlt</td>
<td>T1A range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1ARlFlt</td>
<td>T1A rate fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1BFlt</td>
<td>T1B fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1BRgFlt</td>
<td>T1B range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1BRlFlt</td>
<td>T1B rate fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1DFlt</td>
<td>(T1ARaw-T1BRaw) difference fault</td>
</tr>
<tr>
<td>8</td>
<td>Np (N2) SPEED SENSOR CIRCUIT FAULT</td>
<td>Np12Flt</td>
<td>Np hard fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Np1CyFlt</td>
<td>Np1 continuity check fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Np1Flt</td>
<td>Np1 speed pickup fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Np1RgFlt</td>
<td>Np1 range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Np1RlFlt</td>
<td>Np1 rate fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Np2CyFlt</td>
<td>Np2 continuity check fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Np2Flt</td>
<td>Np2 speed pickup fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Np2RgFlt</td>
<td>Np2 range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Np2RlFlt</td>
<td>Np2 rate fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NpDFlt</td>
<td>(Np1Raw-Np2Raw) difference fault</td>
</tr>
<tr>
<td>9</td>
<td>Ng (N1) SPEED SENSOR CIRCUIT FAULT</td>
<td>Ng12Flt</td>
<td>Ng hard fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ng1CyFlt</td>
<td>Ng1 continuity check fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ng1Flt</td>
<td>Ng1 speed pickup fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ng1RgFlt</td>
<td>Ng1 range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ng1RlFlt</td>
<td>Ng1 rate fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ng2CyFlt</td>
<td>Ng2 continuity check fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ng2Flt</td>
<td>Ng2 speed pickup fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ng2RgFlt</td>
<td>Ng2 range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ng2RlFlt</td>
<td>Ng2 rate fault</td>
</tr>
<tr>
<td>Item No.</td>
<td>FADEC fault category</td>
<td>Maintenance terminal fault code</td>
<td>Fault description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------</td>
<td>-------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>MGT (TGT) THERMOCOUPLE CIRCUIT FAULT</td>
<td>MGTFlt</td>
<td>MGT thermocouple fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MGTGflt</td>
<td>MGT range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MGTTRfIt</td>
<td>MGT rate fault</td>
</tr>
<tr>
<td>11</td>
<td>PERMANENT MAGNET ALTERNATOR (PMA) CIRCUIT FAULT</td>
<td>A128Flt</td>
<td>Alternator (PMA) fault</td>
</tr>
<tr>
<td>12</td>
<td>TORQUE (TMOP OR Q) MEASUREMENT FAULT</td>
<td>QFlt</td>
<td>Torque sensor fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QRgFlt</td>
<td>Q range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QRTfIt</td>
<td>Q rate fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QVldFlt</td>
<td>In-range torque fault</td>
</tr>
<tr>
<td>13</td>
<td>COLLECTIVE PITCH (CP) POTentiometer CIRCUIT FAULT</td>
<td>CPAnFlt</td>
<td>Collective pitch hard fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CPFIt</td>
<td>Collective pitch fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CPRgFlt</td>
<td>Collective pitch range fault</td>
</tr>
<tr>
<td>14</td>
<td>Nr SPEED SENSOR CIRCUIT FAULT</td>
<td>NrAntDb</td>
<td>Disable rotor decay anticipation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NrCyFlt</td>
<td>Nr continuity check fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NrFlt</td>
<td>Nr fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NrRgFlt</td>
<td>Nr range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NrRtfIt</td>
<td>Nr rate fault</td>
</tr>
<tr>
<td>15</td>
<td>ECU P1 TRANSDUCER FAULT</td>
<td>P1Flt</td>
<td>P1 pressure sensor fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P1HdFlt</td>
<td>P1 hard fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P1RGFlt</td>
<td>P1 range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P1RTfIt</td>
<td>P1 rate fault</td>
</tr>
<tr>
<td>16</td>
<td>ECU INTERNAL FAULT</td>
<td>AD12BitFlt</td>
<td>12 bit A/D conversion fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AD8BitFlt</td>
<td>8 bit A/D conversion fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ARINCHWFIt</td>
<td>ARINC hardware fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BacCompFlt</td>
<td>Background complete fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BVIFlt</td>
<td>Bleed valve solenoid BIT current fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CJCFIt</td>
<td>Thermocouple cold junction comp fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CJCRgFlt</td>
<td>Thermocouple cold junction comp range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CJCRtFlt</td>
<td>Thermocouple cold junction comp rate fault</td>
</tr>
<tr>
<td>Item No.</td>
<td>FADEC fault category</td>
<td>Maintenance terminal fault code</td>
<td>Fault description</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>16 (cont.)</td>
<td>ECU INTERNAL FAULT (CONT.)</td>
<td>ECUOTFlt</td>
<td>ECU exceeding allowable temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EECalFlt</td>
<td>EEPROM calibration data fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EEHistFlt</td>
<td>EEPROM engine history data fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EEPROMFlt</td>
<td>EEPROM hardware fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ForCompFlt</td>
<td>Foreground complete fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GainFlt</td>
<td>Gain fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GainRgFlt</td>
<td>Gain range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HLRIFlt</td>
<td>High level reference voltage fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HLRIRgFlt</td>
<td>High level reference voltage range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IgnFlt</td>
<td>Ignition circuit fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OffsFlt</td>
<td>Low level offset fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OffsRgFlt</td>
<td>Low level offset range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OrDiodeFlt</td>
<td>&quot;OR&quot; diode fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSVFlt</td>
<td>Overspeed system voltage fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSVRgFlt</td>
<td>OSV voltage range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PROMFlt</td>
<td>PROM hardware fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PW10Flt</td>
<td>10 volt pulse width modulator fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PW10RgFlt</td>
<td>10 volt pulse width modulator range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RAMFlt</td>
<td>RAM hardware fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>StrFlt</td>
<td>Starter motor circuit fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SWIntFlt</td>
<td>Software interrupt fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UARTFlt</td>
<td>UART hardware fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UUIntFlt</td>
<td>Unused interrupt fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V15Flt</td>
<td>15 volt power supply fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V15RgFlt</td>
<td>15 volt power supply range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V5Flt</td>
<td>5 volt power supply fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V5RgFlt</td>
<td>5 volt power supply range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WDTFlt</td>
<td>Watchdog timer fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WDTOuFlt</td>
<td>Watchdog timer first timeout fault</td>
</tr>
<tr>
<td>17</td>
<td>AIRFRAME 28VDC SUPPLY FAULT</td>
<td>AF28Flt</td>
<td>28 volt airframe power fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AF28RgFlt</td>
<td>28 volt airframe power range fault</td>
</tr>
<tr>
<td>Item No.</td>
<td>FADEC fault category</td>
<td>Maintenance terminal fault code</td>
<td>Fault description</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------------------------</td>
<td>---------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>18</td>
<td>OVERSPEED SYSTEM PUSH-TO-TEST SWITCH CIRCUIT FAULT</td>
<td>OSTstSwFlt</td>
<td>Overspeed test switch fault</td>
</tr>
<tr>
<td>19</td>
<td>FADEC MODE SWITCH CIRCUIT FAULT</td>
<td>AMSwFlt</td>
<td>Auto/Manual switch fault</td>
</tr>
<tr>
<td>20</td>
<td>IGNITION CIRCUIT FAULT</td>
<td>IgniFlt</td>
<td>Ignition relay fault</td>
</tr>
<tr>
<td>21</td>
<td>STEP COUNT FAULT</td>
<td>StepCnFlt</td>
<td>Step count fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WiStFlt</td>
<td>Fuel flow step count fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WiStRgFlt</td>
<td>Fuel flow step count range fault</td>
</tr>
<tr>
<td>22</td>
<td>OPEN METERING VALVE INDICATION</td>
<td>OpenMVFlg</td>
<td>Open metering valve warning prior to start</td>
</tr>
<tr>
<td>23</td>
<td>OVERSPEED SYSTEM ENGINE SHUTDOWN TEST FAULT</td>
<td>OSTestFlt</td>
<td>Automatic overspeed test fault</td>
</tr>
<tr>
<td>24</td>
<td>OVERSPEED SYSTEM Np SPEED SIGNAL FAULT</td>
<td>NpOSFlt</td>
<td>Np overspeed fault</td>
</tr>
<tr>
<td>25</td>
<td>WATCHDOG TIMER HARD FAULT</td>
<td>WDDTTimeOut</td>
<td>Watchdog timer hard fault</td>
</tr>
<tr>
<td>26</td>
<td>UNUSED DISCRETE INPUT FAULT</td>
<td>TestCeiFlt</td>
<td>Engine operating in test cell mode</td>
</tr>
<tr>
<td>27</td>
<td>INCORRECT MAINTENANCE MESSAGE CODES</td>
<td>ARINCFliAn</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CPDFli</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FTempFlt</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LoadSeiFlt</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LoadSHdFlt</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NgOFli</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NgORgFlt</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NgORtFlt</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NrDFli</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P1DFli</td>
<td>NOT VALID FOR THIS INSTALLATION</td>
</tr>
<tr>
<td>28</td>
<td>SECONDARY FAULT CODES</td>
<td>AMFlt</td>
<td>Auto/Manual fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HardFlt</td>
<td>ECU hard fault (fail fixed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or28Flt</td>
<td>28V OR'ed power fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or28RgFlt</td>
<td>28V OR'ed power range fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSFlt</td>
<td>Overspeed system functional fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TempFlt</td>
<td>MGT temperature fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WiHdFlt</td>
<td>Fuel flow hard fault</td>
</tr>
<tr>
<td>Item No.</td>
<td>FADEC fault category</td>
<td>Maintenance terminal fault code</td>
<td>Fault description</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>29</td>
<td>ENGINE LIMITS EXCEEDED</td>
<td>MGTlmtOut</td>
<td>MGT limit exceedence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MGTRLmTOut</td>
<td>MGT run limit exceedence for 12 or more sec.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MGTSLmTOut</td>
<td>MGT start limit exceedence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MGTSRlTmTOut</td>
<td>MGT start limit exceedence for 9 or more sec.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NgLmTOut</td>
<td>Ng limit exceedence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NgRLmTOut</td>
<td>Ng run limit exceedence for 10 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NpLmTOut</td>
<td>Np limit exceedence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NpQExlAdv</td>
<td>NpQ exceedence limit advisory indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NpQRnLmAdv</td>
<td>NpQ run limit advisory indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSFlag</td>
<td>Engine overspeed flag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QLmTOut</td>
<td>Q limit exceedence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QRlTmTOut</td>
<td>Q run limit exceedence for 10 seconds</td>
</tr>
<tr>
<td>30</td>
<td>FUEL FLOW LIMIT EXCEEDED</td>
<td>WILimFlag</td>
<td>Fuel flow has been limited &gt; 10 seconds</td>
</tr>
<tr>
<td>31</td>
<td>ROTOR SPEED TRIM &quot;BEEPER&quot; SWITCH CIRCUIT FAULT</td>
<td>BeepF1t</td>
<td>Cockpit Nr beep fault</td>
</tr>
<tr>
<td>32</td>
<td>ROTOR SPEED TRIM &quot;BEEPER&quot; SWITCH STUCK</td>
<td>BpStuckF1t</td>
<td>Beep stuck fault</td>
</tr>
<tr>
<td>33</td>
<td>INTERMITTENT FAULT PROCEDURE</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>FADEC FAIL WARNING (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>35</td>
<td>FADEC FAIL WARNING (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>36</td>
<td>FADEC MANUAL WARNING (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>37</td>
<td>FADEC MANUAL WARNING (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>38</td>
<td>Ng (N1) COCKPIT GAUGE INOPERATIVE OR ERRATIC</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>Item No.</td>
<td>FADEC fault category</td>
<td>Maintenance terminal fault code</td>
<td>Fault description</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>39</td>
<td>Np (N2) COCKPIT GAUGE INOPERATIVE OR ERRATIC</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>40</td>
<td>OVERSPEED TEST FAILS TO OPERATE</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>41</td>
<td>ENGINE OUT WARNING (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>42</td>
<td>ENGINE OUT WARNING (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>43</td>
<td>FADEC MAINT. ADVISORY (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>44</td>
<td>FADEC MAINT. ADVISORY (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>45</td>
<td>FADEC FAILS FIXED WITH NO MFD FADEC FAIL WARNING</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>46</td>
<td>MANUAL MODE OPERATIONAL PROBLEM</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>47</td>
<td>MAINTENANCE TERMINAL COMMUNICATION FAULT</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>48</td>
<td>FADEC DEGRADE - DROOP MESSAGE (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>49</td>
<td>FADEC DEGRADE - DROOP MESSAGE (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>50</td>
<td>FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>51</td>
<td>FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>52</td>
<td>FADEC DEGRADE - ARINC MESSAGE (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>53</td>
<td>FADEC DEGRADE - ARINC MESSAGE (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>54</td>
<td>FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>55</td>
<td>FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>56</td>
<td>FADEC DEGRADE - TGT (OR MGT) LIM LOSS MESSAGE (MFD) INCORRECTLY &quot;ON&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
<tr>
<td>57</td>
<td>FADEC DEGRADE - TGT (OR MGT) LIM LOSS MESSAGE (MFD) INCORRECTLY &quot;OFF&quot;</td>
<td>Observed condition</td>
<td>See Fault Category Name</td>
</tr>
</tbody>
</table>
The fault isolation/correction procedures were structured to follow a logic that, after listing the symptom and possible causes, specified an initial inspection, measurement, or test, the results of which could be answered yes or no. The subsequent step branched from the yes-no decision to another inspection, measurement, or test, to the next yes-no decision point, and onward until the fault was isolated and corrected. At each step where an inspection, measurement, or test was specified, the corresponding detailed task or procedure from the applicable Technical Manual was referenced. Where no relevant manual (or manual update) was available, such as the airframe manual associated with the 250-C30R/3 engine, similar sections of the T703-AD-700 powered airframe manual (TM55-1520-248-23) were referenced with the notation “similar to . . .”

6.2 Visio Flow Charts of Troubleshooting/Diagnostic Procedures

The troubleshooting/diagnostic procedures were arranged in flow chart format, using Visio software, and are presented as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Appendix</th>
</tr>
</thead>
<tbody>
<tr>
<td>T703-AD-700 engine</td>
<td>A</td>
</tr>
<tr>
<td>250-C30R/3 basic engine</td>
<td>B</td>
</tr>
<tr>
<td>250-C30R/3 FADEC</td>
<td>C</td>
</tr>
</tbody>
</table>

Although the creation of the Visio charts is an interim step in the execution of this ATEDS contract, note that even in the graphic format they provide a more systematic approach to fault isolation and correction than has heretofore been available to the mechanic, and thus may be useful in maintaining the OH-58D fleet until ATEDS is implemented.

6.3 Standard Generalized Markup Language (SGML) Tagged Data

The text and logic from Visio charts of the troubleshooting/diagnostic procedures were used directly as inputs to the SGML tagging. SGML tagged data, while the final product of this contract, is not the final step in creating the envisioned Aviation Turbine Engine Diagnostic System. The tagged data must be processed with other software to provide the meaningful portable computer input/output a mechanic would use to maintain the engine.

Appendix D contains a printout of a sample SGML-tagged data file, based on one of the simpler fault correction procedures (250-C30R/3 basic engine procedure R-6—*Gas Generator Idle Speed Too High or Too Low*)—to provide a general view of the structure of the language. A complete set of the tagged data files, for all 159 procedures, has already been provided to the Army on CD-ROM and is not included herein.

A brief description of the SGML tagging process, as well as identification of the additional software required to provide a usable system, is also included in Appendix D.

6.4 Specialized Test Equipment Required to Support Troubleshooting and Diagnosing

Specialized test equipment required to implement troubleshooting of engine and engine-to-aircraft interface faults is presented in Appendix E. Six items were identified. A list, relating specific equipment to the various troubleshooting procedures, is also included. A variety of equipment required to perform common maintenance and repair functions, such as special lifting and handling fixtures, wrenches, lip seal pullers, vibration measuring systems, etc., is already in the Army inventory and thus currently available.
Appendix A

T703-AD-700 Fault Isolation and Correction Visio Charts

51 Procedures (63 pages)
ST-1 STARTER UNABLE TO MOTOR ENGINE TO FUEL INTRODUCTION SPEED (12 - 15% Ng).

THIS MAY BE CAUSED BY: Low battery Inefficient starter. GGT rotor or turbine rub or drag. Inlet blockage or exhaust blockage or damage.

START HERE: Inspect the compressor inlet for damage or blockage, TM 55-2840-248-23, task 3-6-1. Rotate by hand to check for binding or unusual noise.

Replace compressor module, TM 55-2840-256-23, tasks 3-1-1, 3-1-2.

Yes

Start OK?

Replace accessory gearbox, TM 55-2840-256-23, task 6-1-2, 6-1-3.

No

Start OK?

Replace the engine, TM 55-2840-256-23, Task 4-1-1, 4-1-2.

Check aircraft electrical system to make sure that minimum required voltage is available to the starter-generator, TM 55-1520-248-23, task 9-1-19. If the minimum required VDC is not available, install a serviceable battery or use external power (APU), TM 55-1520-248-23, task 9-3-3, 9-3-9, 9-3-10, 9-3-11.

Repair necessary?

Yes

Start OK?

No

Start OK?


Start OK?

No

Return to service

Yes
ST-2 ENGINE FAILS TO LIGHT OFF.


START HERE. Check cockpit switches to make certain that boost pumps are on and running.

Were boost pumps OFF? Yes→

Start OK?

No→

Check and re-install, or replace the fuel nozzle, TM 55-2840-256-23, task 7-4-1 thru 7-4-5.

Start OK?

No→

Check fuel control flow schedule, TM 55-2840-256-23, task 7-2-3. Adjust if necessary, task 7-2-9.

Start OK?

Refuel necessary?

Yes→

Start OK?

No→

Check fuel control throttle rigging. TM 55-2840-256-23, task 7-2-1. Adjust if necessary. TM 55-1520-248-23, task 4-6-1.

Start OK?

Adjustment necessary?

Yes→

Return to service

No→

Listen for igniter operation, TM 2840-256-23, Task 8-2-1 and observe the exhaust for visible fuel vapor while motoring. If no vapor, purge the engine fuel system. TM 55-2840-256-23, task 7-1-1.

Start OK?

Confirm description of reported problem. Re-address according to re-defined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-284-256-23.
ST-3 ENGINE LIGHTS OFF PRIOR TO REACHING FUEL INTRODUCTION SPEED. (PREMATURE LIGHT OFF).

THIS MAY BE CAUSED BY: Fuel control cut off valve leaking or not closed during initial crank. Combustor drain valve stuck closed.

NOTE: If light-off occurs at a very low cranking speed, a hot start will usually result unless fuel flow to the engine is immediately shut off by either throttle closure or by fuel shut valve closure if the fuel control cutoff valve is leaking.

START HERE: Inspect the fuel control throttle linkage and cut off valve to make certain that the throttle lever is against its minimum stop and cutoff valve is seated. TM 55-2840-256-23, tasks 7-2-1, 7-2-6.

Repair necessary?

Yes

Inspect the combustor drain valve for proper function, and that its drain line is not blocked. TM 55-2840-256-23, task 4-5-1 thru 4-5-3.

No

Start OK?

Yes

Return to service

No

Replace the fuel control TM 55-2840-256-23, tasks 7-2-11, 7-2-12.

Start OK?

Yes

Confirm description of problem. Re-address according to re-defined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.
ST-4 ENGINE LIGHTS OFF BUT ACCELERATION RATE IS SLOW WITH LOW TGT (APPROX. 550 Degrees C.) MAY STAGNATE (HANG) AROUND 30% Ng.


START HERE: Inspect the anti-icing air valve to ensure that it is "off" and not leaking. TM 55-2840-256-23, task 9-1-1, 9-1-2, 9-2-1, 9-2-2.

- **Start OK?**
  - Yes: Adjustment required?
    - Yes: Start OK?
      - No: No
    - No: No
  - No: Attempt start with electronic supervisory control switch in BACKUP position.

- **Start OK?**
  - Yes: Replace electronic supervisory control. TM 55-1520-248-23, task 9-7-2, 9-7-3.
  - No: Check fuel control air sensing tubes for leakage. TM 55-2840-256-23, task 7-2-4. Service Pc air filter, task 7-2-7.

- **Repair necessary?**
  - Yes: Repair necessary?
    - Yes: Return to service
      - No: No
    - No: No
  - No: No

- **Start OK?**
  - No: No

- **Remove and inspect fuel nozzle. Replace if necessary. TM 55-2840-256-23, tasks 7-4-1 thru 7-4-5.**

- **Repair necessary?**
  - Yes: Start OK?
    - No: No
  - No: No

- **Check for cracks in the compressor air transfer tubes or outer combustion case. Check for air transfer air tube seal leaks, TM 55-2840-256-23, task 4-1-1.**

- **Repair necessary?**
  - Yes: Start OK?
    - No: No
  - No: No

- **Replace fuel control TM 55-2840-256-23, tasks 7-2-11, 7-2-12.**

- **Start OK?**
  - Yes: Yes
  - No: No

Confirm description of problem. Re-address according to redefined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.
ST-5 ENGINE LIGHTS OFF BUT ACCELERATION RATE IS SLOW WITH HIGHER THAN NORMAL TGT.


Listen for unusual sounds (noise) emanating from the engine.

Sounds normal? No

Check aircraft electrical system to make certain that minimum required voltage is available to the starter. TM 55-1520-248-23, task 9-1-19.

Repair necessary? Yes

Check TGT indicating system TM 55-1520-248-23, Chapter 8, Section 1.

Repair necessary? Yes

Inspec the anti-icing air valve to make certain that it is OFF and not leaking. TM 55-2840-256-23, tasks 9-1-1, 9-1-2, 9-2-1, 9-2-2.

Repair necessary? Yes


Start OK?

No

Check fuel nozzle flow pattern. TM 55-2840-256-23, task 7-4-3.

Start OK?

Yes

Repair necessary? No

No

End.

Start OK?

Yes

Replace compressor module. TM 55-2840-256-23, task 3-1-2.

Start OK?

Yes

Replace accessory gearbox, TM 55-2840-256-23, task 6-1-2, 6-1-3.

Start OK?

Yes

Confirm description of problem. Re-address according to re-defined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.

End.
ST-6 TGT TOO HIGH DURING START.


START HERE: Inspect the TGT indicating system. TM 55-1520-248-23, task 8-1-1. Repair or replace as necessary, tasks 8-1-10, 8-1-11.

- Repair necessary?
  - Yes
    - Repair necessary?
      - Yes
        - Start OK?
          - Yes
            - Repair necessary?
              - Yes
                - Check or replace starter-generator. TM 55-1520-248-23, tasks 9-3-14, 9-3-15.
              - No
                - Start OK?
                  - Yes
                    - Check fuel control flow schedule. TM 55-2840-256-23, task 7-2-3. Adjust if required, task 7-2-9.
                  - No
                    - Adjustment required?
                      - Yes
                        - Start OK?
                          - Yes
                            - Service or replace fuel nozzle. TM 55-2840-256-23, task 7-4-1 thru 7-4-5.
                          - No
                            - Start OK?
                              - Yes
                                - Repair necessary?
                                  - Yes
                                    - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                  - No
                                    - Start OK?
                                      - Yes
                                        - Return to service
                                      - No
                                        - ST-6A next page
        - No
          - Start OK?
            - Yes
              - Repair necessary?
                - Yes
                  - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                - No
                  - Start OK?
                    - Yes
                      - Check the fuel control cut off valve. TM 55-2840-256-23, task 7-2-1 and 7-2-6. Adjust rigging as necessary, TM 55-1520-248-23, task 4-6-1.
                    - No
                      - Repair necessary?
                        - Yes
                          - Start OK?
                            - Yes
                              - Repair necessary?
                                - Yes
                                  - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                  - No
                                    - Start OK?
                                      - Yes
                                        - Check the fuel control cut off valve. TM 55-2840-256-23, task 7-2-1 and 7-2-6. Adjust rigging as necessary, TM 55-1520-248-23, task 4-6-1.
                                        - No
                                          - Repair necessary?
                                            - Yes
                                              - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                              - No
                                                - Start OK?
                                                  - Yes
                                                    - Repair necessary?
                                                      - Yes
                                                        - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                        - No
                                                          - Repair necessary?
                                                            - Yes
                                                              - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                              - No
                                                                - Start OK?
                                                                  - Yes
                                                                    - Repair necessary?
                                                                      - Yes
                                                                        - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                                        - No
                                                                          - Repair necessary?
                                                                            - Yes
                                                                              - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                                              - No
                                                                                - Start OK?
                                                                                  - Yes
                                                                                    - Repair necessary?
                                                                                      - Yes
                                                                                       - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                                                       - No
                                                                                         - Repair necessary?
                                                                                           - Yes
                                                                                             - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                                                             - No
                                                                                               - Start OK?
                                                                                                 - Yes
                                                                                                   - Repair necessary?
                                                                                                    - Yes
                                                                                                     - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                                                                     - No
                                                                                                       - Repair necessary?
                                                                                                         - Yes
                                                                                                             - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                                                                             - No
                                                                                                               - Start OK?
                                                                                                                 - Yes
                                                                                                                   - Repair necessary?
                                                                                                                    - Yes
                                                                                                                     - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                                                                                     - No
                                                                                                                       - Repair necessary?
                                                                                                                         - Yes
                                                                                                                             - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                                                                                             - No
                                                                                                                               - Start OK?
                                                                                                                                  - Yes
                                                                                                                                     - Repair necessary?
                                                                                                                                       - Yes
                                                                                                                                            - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                                                                                                            - No
                                                                                                                                             - Repair necessary?
                                                                                                                                                - Yes
                                                                                                                                                    - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                                                                                                                    - No
                                                                                                                                                     - Start OK?
                                                                                                                                                    - Yes
                                                                                                                                                       - Repair necessary?
                                                                                                                                                           - Yes
                                                                                                                                                                           - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                                                                                                                                           - No
                                                                                                                                                                               - Repair necessary?
                                                                                                                                                                                               - Yes
                                                                                                                                                                                                   - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                                                                                                   - No
                                                                                                                                     - Repair necessary?
                                                                                - No
                                                                                              - Start OK?
                                                                                               - Yes
                                                                                                 - Repair necessary?
                                                                                                - Yes
                                                                                                      - Start OK?
                                                                                                          - Yes
                                                                                                            - Repair necessary?
                                                                                                               - Yes
                                                                                                                  - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                                                                                  - No
                                                                                                                    - Repair necessary?
                                                                                                                      - Yes
                                                                                                                           - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                                                                                           - No
                                                                                                                             - Start OK?
                                                                                                                                - Yes
                                                                                                                                  - Repair necessary?
                                                                                                                                   - Yes
                                                                                                                                     - Inspect the combustor drain valve, TM 55-2840-256-23, task 4-5-2.
                                                                                                                                     - No
                                                                                                                                             - Repair necessary?
                                                                                                                                                - Yes
                                                                                                                                                    - Check aircraft electrical system to make certain that minimum required voltage is available at the starter. TM 55-1520-248-23, task 9-1-19.
                                                                                                                                                    - No
                                                                                                                                                     - Start OK?
                                                                                                                                                     - Yes
                                                                                                                                                         ...
Inspect the compressor scroll, TM 55-2840-256-23, task 3-3-1.

Repair necessary?  

No  

Start OK?

Yes  

Inspect the 1st stage nozzle shield, nozzle, and turbine wheel. TM 55-2840-256-23, task 5-1-1.

Repair necessary?  

No  

Start OK?

Yes  

Attempt start with electronic supervisory control switch in BACKUP position.

Start OK?

Yes  

Replace electronic supervisory control TM 55-1520-248-23, task 9-7-2, 9-7-3.

Start OK?

Yes  

Return to service

No  

Replace fuel control TM 55-2840-256-23, tasks 7-3-11, 7-3-12.

Start OK?

Yes  

Replace engine TM 55-1520-248-23, task 4-1-1, 4-1-2.
ST-7 ENGINE ACCELERATES TO OVERSPEED DURING START.

This may be caused by: Fuel control throttle rigging. Frosting or icing of the Py governing orifice in the fuel control. Fuel control failure.

Start here: Check the fuel control throttle rigging. TM 55-2840-256-23, task 7-2-1. Rig and adjust as necessary, TM 55-1520-248-23, task 4-6-1

Fault corrected?

Yes

Return to service

No

Perform another start. If Ng continues to increase beyond idle (63-65%) use the twist grip start modulation range below idle to control Ng in the normal idle speed range (63-65%) until the fuel control warms up.

Ng controllable by modulation?

Yes

As the fuel control warms and it becomes possible to advance the twist grip throttle without Ng exceeding idle (63-65%), slowly advance twist grip toward the idle position. After sufficient warming to permit engine operation in the idle speed range with twist grip at the idle detent, slowly increase twist grip setting until Nr/Np reach 100% with rotor at flat pitch. Continue to advance twist grip to its maximum stop position. If Nr/Np continue to hold at 100%, the governor system is now controlling the engine normally. If Nr/Np tend to exceed 100%, use the twist grip throttle to limit Nr/Np for 3 or 4 minutes to allow further warming. If still unable to advance twist grip to its full open stop without overspeeding Nr/Np, return to idle and shut the engine down.

No

Shut down and try another start, again attempting to control Ng speed by modulation. Repeat this shut down and re-start every 3-4 minutes for a total of not more than 4 attempts.

Ng controllable by modulation?

Yes

No

Fault corrected?

Yes

Replace fuel control, TM 55-2840-256-23, task 7-2-11, 7-2-12.

No

Return to service
ST-8 ENGINE LIGHTS OFF BUT FLAMES OUT DURING GROUND STARTS AT HIGH ALTITUDE, ESPECIALLY ABOVE 5000 FT. (1824 METERS) AT COOL TEMPERATURES.


START HERE: Aircraft adequately fueled with proper fuel type? TM 55-2840-256-23, task 1-4-1.

- Refuel necessary? Yes

  - No

  - Start OK?

  - Yes

  - Start OK?

  - No

  - Check aircraft fuel system to make sure all lines are open and pumps are running: Disconnect aircraft fuel supply tube at the fuel control inlet port. Connect a hose to the tube and direct the hose into a bucket or similar container. Make sure the aircraft fuel shut off valve is fully open (lever fully forward). Turn fuel boost switch on forward overhead console ON. Verify that fuel is flowing into the bucket. Capture at least two gallons of fuel, then turn fuel boost switch OFF. Verify that fuel flow ceases. Check the fuel sample for evidence of water or other contaminant. Remove and replace engine fuel filter element, TM 55-2840-256-23, task 7-5-7. Reconnect the fuel control fuel inlet tube and purge the engine fuel system, TM 55-2840-256-23, task 7-1-1.

  - Service or replace fuel nozzle. TM 55-2840-256-23, tasks 7-4-1 thru 7-4-5.

  - No

  - Start OK?

  - Yes

  - Return to service.

  - No

  - Remove combustion module, TM 55-2840-256-23, task 4-1-4, to access combustion liner. Replace liner and re-install combustion module, tasks 4-1-3 or 4-1-5.

  - Start OK?

  - No

  - Inspect first stage turbine nozzle shield. TM 55-2840-256-23, task 5-1-1.

  - Yes

  - Start OK?

  - No

  - Confirm description of problem. Re-address according to redefined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.

  - Yes
ST-9 COMPRESSOR SURGE DURING STARTING.


START HERE: Attempt start with electronic supervisory control switch in BACKUP position.

- **Start OK?**
  - Yes
    - Replace electronic supervisory control
    - TM 55-1520-248-23, task 9-7-2, 9-7-3.
  - No
    - Visually inspect compressor bleed valve (T703-AD-700B engine only)
    - TM 55-2840-256-23, task 9-4-1, 9-4-2.

- **Repair necessary?**
  - Yes
    - Start OK
  - No
    - Remove air induction cowl to gain access to compressor inlet area.
    - TM 55-1520-248-23, task 4-2-1. Inspect compressor front support and inlet vanes and blades for damage, erosion or dirt built up.
    - TM 55-2840-256-23, task 3-6-1.

- **Comp. damaged or eroded?**
  - Yes
  - No
    - Comp. dirty?
      - Yes
        - Perform compressor wash TM 55-2840-256-23, task 3-2-2.
      - No
      - Start OK?
ST-10 MAIN ROTOR AND Np DO NOT ROTATE BY 25% Ng DURING START.

THIS MAY BE CAUSED BY: Improper oil type in cold weather. Excessive drag in aircraft power train. Accessory gearbox internal fault. Turbine wheel rub.

- Is ambient temp. below -40 C.(-40F)?
  - Yes: Replace accessory gearbox, TM 55-2840-256-23, task 6-1-2, 6-1-3.
  - No: Re-service necessary?
    - Yes: Start OK?
      - Yes: Rotate freely?
        - Yes: Replace turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3.
        - No: Re-install engine TM 55-1520-248-23, task 4-1-2. Service the oil system TM 55-1520-248-23, tasks 1-4-5 and 1-4-5.1 and TM 55-2840-256-23, task 1-8-1.
      - No: Attempt to walk the main rotor backward (opposite the normal direction or rotation). DO NOT USE EXCESSIVE FORCE.
    - No: Start OK?
      - Yes: Return to service
      - No: Rotate freely?

- Troubleshoot and repair the aircraft power train, TM 55-1520-248-23, Chapter 6.

- Disconnect the engine to transmission drive shaft. TM 55-1520-248-23, task 6-2-2. Attempt to rotate the engine by hand through the drive shaft coupling.

Remove the engine, TM 55-1520-248-23, task 4-1-1. Remove turbine module, TM 55-2840-256-23, task 5-1-2. Check power turbine rotor for freedom of rotation.
THIS PROBLEM IS CHARACTERIZED BY: A somewhat sharp "WOOF" sound, frequently accompanied by a brief torching from the engine exhaust. Possible causes are: Fuel control cut off valve not fully closed, or leaking. Faulty ignition exciter, lead, or spark igniter. Faulty combustor drain valve. Faulty check valve in engine oil system. Fuel nozzle spray pattern or flow divider. Fuel nozzle shimming.

Check the fuel control throttle linkage to make certain that the throttle lever is against its minimum stop with twist grip in CUTOFF position, TM 55-2840-256-23, task 7-2-1 and 7-2-6. Adjust rigging as necessary, TM 55-1520-246-23, task 4-6 1.

Repair necessary?

Yes → Firing rate OK?

Yes → Start OK?

Yes → Remove and test Ignition lead, TM 55-2840-256-23, tasks 8-5-1, 8-5-2 Replace if faulty.

No → Start OK?

Yes → Firing rate OK?

Yes → Start OK?

Yes → Remove and inspect spark igniter, TM 55-2830-256-23, tasks 8-4-1, 8-4-2. Replace if necessary.

No → Return to service

Return to service

Remove, service and reinstall combustor drain valve, TM 55-2840-256-23, tasks 4-5-1, 4-5-2, 4-5-3. Check for oil drainage from the drain port while drain valve is removed.

Oil drainage?

Yes → Run engine at ground idle until oil temp. stabilizes. Shut down and remove combustor drain valve as soon as the engine stops turning. Place a container under the combustor drain port. Measure the oil collected after one hour and again after two hours.

No → Test ignition exciter, TM 55-2840-356-23, task 8-2-1.

ST-11A

Yes → Start OK?

Yes → ST-11B next page

No → Replace ignition exciter, TM 55-2840-256-23, tasks 8-2-2, 8-2-3.

ST-11C

Yes → Replace engine, TM 55-1520-246-23, tasks 4-1-1, 4-1-2.
Still leaking after first hour?

Yes → Reinstall combustor drain valve. TM 55-2840-256-23, task 4-5-3.

No → Replace external turbine oil check valve. (Right side of engine just below horizontal heat shield, direction of flow arrow pointing aft) Reinstall combustor drain valve, TM 55-2840-256-23, task 4-5-3. Run engine at ground idle until oil temp stabilizes. Shut down and observe for oil drainage through combustor drain valve.

Oil still draining?

Yes → Start OK?

No → ST-11C first page

Start OK?

Yes → Return to service

No → Replace main oil system check valve, TM 55-2840-256-23, task 6-2-3, 6-2-4. This requires removal/reinstallation of the oil filter housing.
ST-12. NO OIL PRESSURE INDICATION DURING START.

THIS MAY BE CAUSED BY: Main oil pump not properly primed. Restriction in oil pump supply line. Low oil level in tank. Dirty oil filter. Faulty aircraft oil pressure sensor or indicator. Leaks within the oil filter housing. Oil pressure regulator sticking. Oil pump or oil pump drive failure. Accessory gearbox problem.

- If oil pressure is below 50 PSIG when the engine reaches ground idle, comply with trouble shooting procedure No. 17, page 157, TM 55-2840-256-23.
  - Replace oil pressure transducer, TM 55-1520-248-23, task 4-1-4. Repeat task 4-1-3, bleeding the transducer line first.
  - Remove and inspect oil pressure regulator assembly. Repair or replace as necessary, TM 55-2840-256-23, tasks 6-2-5 through 6-2-6.

- If oil pressure is ZERO when the engine reaches ground idle, service the oil system, TM 55-1520-248-23, task 1-4-5.1. BLEED OIL PUMP SUPPLY LINE AS REQUIRED.
  - Oil pressure OK on next start?
    - Yes
      - Oil pressure OK on next start?
        - Yes
          - Inspect, service, replace, oil filter element, TM 55-2840-256-23, tasks 6-2-10 through 6-2-13.
        - No
          - Oil pressure OK on next start?
            - Yes
              - Troubleshoot and repair, as necessary, cockpit oil pressure indicator and related aircraft wiring, TM 55-1520-248-23, Appendix K, Section III.
            - No
              - Oil pressure OK on next start?
                - Yes
                  - Check oil pressure transducer, TM 55-2840-256-23. task 4-1-3. Motor engine and loosen Tee fitting at oil pressure transducer inlet to bleed the system prior to start.
                - No
                  - Oil pressure OK on next start?
                    - Yes
                      - Return to service
                    - No
                      - Oil pressure OK on next start?
                        - Yes
                          - Return to service
                        - No
                          - Oil pressure OK on next start?
                            - Yes
                              - Return to service
                            - No
                              - Oil pressure OK on next start?
                                - Yes
                                  - Check oil pressure transducer, TM 55-2840-256-23. task 4-1-3. Motor engine and loosen Tee fitting at oil pressure transducer inlet to bleed the system prior to start.
                                - No
                                  - Oil pressure OK on next start?
                                    - Yes
                                      - Return to service
                                    - No
                                      - Oil pressure OK on next start?
                                        - Yes
                                          - Return to service
                                        - No
                                          - Oil pressure OK on next start?
                                            - Yes
                                              - Return to service
                                            - No
                                              - Oil pressure OK on next start?
                                                - Yes
                                                  - Return to service
                                                - No
                                                  - Oil pressure OK on next start?
                                                    - Yes
                                                      - Return to service
                                                    - No
                                                      - Oil pressure OK on next start?
                                                        - Yes
                                                          - Return to service
                                                        - No
                                                          - Oil pressure OK on next start?
                                                            - Yes
                                                              - Return to service
                                                            - No
                                                              - Oil pressure OK on next start?
                                                                - Yes
                                                                  - Return to service
                                                                - No
                                                                  - Oil pressure OK on next start?
                                                                    - Yes
                                                                      - Return to service
                                                                    - No
                                                                      - Oil pressure OK on next start?
                                                                        - Yes
                                                                          - Return to service
                                                                        - No
                                                                          - Oil pressure OK on next start?
                                                                            - Yes
                                                                              - Return to service
                                                                            - No
                                                                              - Oil pressure OK on next start?
                                                                                - Yes
                                                                                  - Return to service
                                                                                - No
                                                                                  - Oil pressure OK on next start?
                                                                                      - Yes
                                                                                       - Return to service
                                                                                      - No
                                                                                       - Oil pressure OK on next start?
                                                                                        - Yes
                                                                                           - Return to service
                                                                                        - No
                                                                                           - Oil pressure OK on next start?
                                                                                            - Yes
                                                                                                - Return to service
                                                                                                - No
                                                                                                - Oil pressure OK on next start?
                                                                                                    - Yes
                                                                                                      - Return to service
                                                                                                      - No
                                                                                                      - Oil pressure OK on next start?
                                                                                                          - Yes
                                                                                                             - Return to service
                                                                                                             - No
                                                                                                             - Oil pressure OK on next start?
                                                                                                                 - Yes
                                                                                                                     - Return to service
                                                                                                                     - No
                                                                                                                     - Oil pressure OK on next start?
                                                                                                                         - Yes
                                                                                                                             - Return to service
                                                                                                                             - No
                                                                                                                             - Oil pressure OK on next start?
                                                                                                                               - Yes
                                                                                                                                   - Return to service
                                                                                                                                   - No
                                                                                                                                   - Oil pressure OK on next start?
                                                                                                                                       - Yes
                                                                                                                                             - Return to service
                                                                                                                                             - No
                                                                                                                                             - Oil pressure OK on next start?
                                                                                                                                                - Yes
                                                                                                                                                    - Return to service
                                                                                                                                                    - No
                                                                                                                                                    - Oil pressure OK on next start?
                                                                                                                                 - Yes
                                                                                                                                              - Return to service
                                                                                                                                              - No
                                                                                                                                              - Oil pressure OK on next start?
                                                                                                                                                          - Yes
                                                                                                                                                              - Return to service
                                                                                                                                                              - No
                                                                                                                                                              - Oil pressure OK on next start?
                                                                                                                                                                  - Yes
                                                                                                                                                                      - Return to service
                                                                                                                                                                      - No
                                                                                                                                                                      - Oil pressure OK on next start?
                                                                                                                                                                          - Yes
                                                                                                                                                                              - Return to service
                                                                                                                                                                              - No
                                                                                                                                                                              - Oil pressure OK on next start?
                                                                                                                                                                                  - Yes
                                                                                                                                                                                      - Return to service
                                                                                                                                                                                      - No
                                                                                                                                                                                      - Oil pressure OK on next start?
                                                                                                                                                                                          - Yes
                                                                                                                                                                                              - Return to service
                                                                                                                                                                                              - No
                                                                                                                                                                                              - Oil pressure OK on next start?
                                                                                                                                                                                                  - Yes
                                                                                                                                                                                                      - Return to service
                                                                                                                                                                                                      - No
                                                                                                                                                                                                      - Oil pressure OK on next start?
                                                                                                                                                                                                           - Yes
                                                                                                                                                                                                                - Return to service
                                                                                                                                                                                                                - No
                                                                                                                                                                                                                - Oil pressure OK on next start?
                                                                                                                                                                                                                       - Yes
                                                                                                                                                                                                                           - Return to service
                                                                                                                                                                                                                           - No
                                                                                                                                                                                                                           - Oil pressure OK on next start?
                                                                                                                                                                                                                                           - Yes
                                                                                                                                                                                                                                               - Return to service
                                                                                                                                                                                                                                               - No
                                                                                                                                                                                                                                               - Oil pressure OK on next start?
                                                                                                                                                                                                                                                   - Yes
                                                                                                                                                                                                                                                       - Return to service
                                                                                                                                                                                                                                                       - No
                                                                                                                                                                                                                                                       - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                       - Yes
                                                                                                                                                                                                                                                                       Return to service
                                                                                                                                                                                                                                                                       - No
                                                                                                                                                                                                                                                                       - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                             - Yes
                                                                                                                                                                                                                                                                                - Return to service
                                                                                                                                                                                                                                                                                - No
                                                                                                                                                                                                                                                                                - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                    - Yes
                                                                                                                                                                                                                                                                                    Return to service
                                                                                                                                                                                                                                                                                    - No
                                                                                                                                                                                                                                                                                    - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                 - Yes
                                                                                                                                                                                                                                                                              - Return to service
                                                                                                                                                                                                                                                                              - No
                                                                                                                                                                                                                                                                              - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                          - Yes
                                                                                                                                                                                                                                                                                              - Return to service
                                                                                                                                                                                                                                                                                              - No
                                                                                                                                                                                                                                                                                              - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                                                                 - Yes
                                                                                                                                                                                                                                                                                                                                 Return to service
                                                                                                                                                                                                                                                                                                                                 - No
                                                                                                                                                                                                                                                                                                                                 - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                                                                                          - Yes
                                                                                                                                                                                                                                                                                                                                                              - Return to service
                                                                                                                                                                                                                                                                                                                                                              - No
                                                                                                                                                                                                                                                                                                                                                              - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                                                                                                           - Yes
                                                                                                                                                                                                                                                                                                                                                                               - Return to service
                                                                                                                                                                                                                                                                                                                                                                               - No
                                                                                                                                                                                                                                                                                                                                                                               - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                                                                                                                   - Yes
                                                                                                                                                                                                                                                                                                                                                                                                   - Return to service
                                                                                                                                                                                                                                                                                                                                                                                                   - No
                                                                                                                                                                                                                                                                                                                                                                                                   - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                                                                                                                                 - Yes
                                                                                                                                                                                                                                                                                                                                                                                                 Return to service
                                                                                                                                                                                                                                                                                                                                                                                                 - No
                                                                                                                                                                                                                                                                                                                                                                                                 - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                                                                                                                                                          - Yes
                                                                                                                                                                                                                                                                                                                                                                                                                              - Return to service
                                                                                                                                                                                                                                                                                                                                                                                                                              - No
                                                                                                                                                                                                                                                                                                                                                                                                                              - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 - Yes
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 Return to service
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 - No
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 - Oil pressure OK on next start?
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          - Yes

START HERE: Check for electronic supervisory control faults on the cockpit control panel. TM 55-1520-248-23 M.T.F. Section B-5. Clear faults indicated.

- Faults corrected?
  - Yes
  - Idle OK?
    - Yes
    - Repair necessary?
      - Yes
      - Check aircraft electrical system. TM 55-1520-248-23, task 9-1-19.
      - No
      - No
    - No
    - No
  - No
  - Set electronic supervisory control switch to BACKUP. If this corrects the problem, replace electronic supervisory control, TM 55-1520-248-23, task 9-7-2, 9-7-3.

- Idle OK?
  - Yes
  - Check fuel control throttle rigging. TM 2840-256-23, task 7-2-1. Adjust as necessary, task 4-6-1.
  - No
  - Adjustment necessary?
    - Yes
    - Idle OK?
      - Yes
      - Return to service.
      - No
      - No
    - No
    - Check fuel control air sensing tubes for leaks. TM 55-2840-256-23, task 7-2-1.
Check or replace compressor bleed valve (T703-AD-700B engine only) TM 55-2840-256-23, tasks 9-4-1, 9-4-2.

Idle OK?

Yes

No

Replace fuel control TM 55-2840-256-23, tasks 7-2-11, 7-2-12.

Return to service

Idle OK?

Yes

No

Confirm description of reported problem. Re-address according to redefined description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.
RG-2. IDLE SPEED CYCLES (UNSTABLE) AT 100% Nr/Np, MAIN ROTOR AT FLAT PITCH (FLIGHT IDLE).


START HERE: Inspect the Np beeper switch for proper mechanical and electrical integrity and function TM 55-1520-248-23, task 9-1-19.

Repair necessary?  
Yes  
No

Runs OK

Set electronic supervisory control in BACKUP position. If this corrects the problem, replace electronic supervisory control, TM 55-1520-248-23, task 9-7-2, 9-7-3.

Runs OK

Check aircraft fuel system to make sure that all valves are open and unrestricted and pumps are running. Disconnect aircraft fuel supply tube at the fuel control inlet port. Connect a hose to the tube and route it to a bucket or similar container. Make sure the aircraft fuel shut off valve is fully open (lever fully forward). Turn fuel boost switch on forward overhead console ON. Verify that fuel is flowing into the bucket. Capture at least two gallons of fuel, then turn fuel boost switch OFF. Verify that fuel flow ceases. Check the fuel sample for evidence of water or other contaminant. Remove and replace engine fuel filter element TM 55-2840-256-23, task 7-5-7. Reconnect the fuel control fuel inlet tube and purge the engine fuel system TM 55-2840-256-23, task 7-1-1.

Yes  
No

Runs OK

Troubleshoot the aircraft electrical system, TM 55-1520-248-23, section 9-3.

Repair necessary?

Yes  
No

Check fuel control air sensing tubes for leaks. TM 55-2848-256-23, task 7-2-4.

Repair necessary?

Yes  
No

Test the collective lever potentiometer, TM 55-1520-248-23.

Yes  
No

Replace the compressor bleed valve (T703-AD-700B engine only) TM 55-2840-256-23, task 9-4-1, 9-4-2.

Runs OK

Replace the fuel control. TM 55-2840-256-23, task 7-2-11, 7-2-12.

Return to service
RG-3 IDLE SPEED DOES NOT REPEAT TO THE DESIRED SET POINT ON REPEATED THROTTLE MOVEMENTS FROM, AND RETURNING TO, IDLE.

THIS MAY BE CAUSED BY: Fuel control throttle rigging or security. Fuel control malfunction. Electronic supervisory control.


Repair necessary?  
Yes  
Run OK?  
Yes  
Replace electronic supervisory control TM 55-1520-248-23, task 9-7-2, 9-7-3.

No  
Run OK?  
Yes  
Runs OK?  
Yes  
Return to service

No  
Check fuel control throttle rigging, TM 55-2840-256-23, task 7-2-1. Repair, adjust as necessary, TM 55-1520-248-23, task 4-6-1.

Run OK?  
Yes

No  
Replace fuel control, TM 55-2840-256-23, task 7-2-11, 7-2-12.


Repair necessary?

No

Yes

Idle OK?

No

Set electronic supervisory control switch to BACKUP. If this corrects the problem, replace electronic supervisory control, TM 55-1520-248-23, task 9-7-2, 9-7-3.

Yes

Idle OK?

No

Turn off all aircraft electrical systems not essential to engine operation.

Yes

Troubleshoot the electrical system to correct cause of excessive load. TM 55-1520-248-23, chapter 9, Sections II through VIII.

Idle OK?

No

Inspect the Ng indicating system, TM 55-1520-248-23, task 8-1-1.

Repair necessary?

No

Yes

Return to service

Yes

Idle OK?

No

Replace fuel control, TM 55-2840-256-23, tasks 7-2-11, 7-2-12.

Replace engine, TM 55-1520-248-23, task 4-1-1, 4-1-2.
RG-5 IDLE SPEED TOO HIGH. WILL NOT RESPOND TO IDLE SPEED DECREASE ADJUSTMENT. MAY RESPOND TO GROSS IDLE SPEED INCREASE ADJUSTMENT.


START HERE: Check for electronic supervisory control fault code on the cockpit control panel. TM 55-1520-23 M.T.F. Section B-5. Clear any faults recorded.

Repair necessary? Yes

Idle OK? No

Set electronic supervisory control switch in BACKUP position. If this corrects the problem, replace electronic supervisory control, TM 55-1520-248-23, tasks 9-7-2, 9-7-3.

Idle OK? Yes

Inspection the Ng Indicating system, TM 55-2840-256-23, task 8-1-1.

Repair necessary? Yes

Idle OK? No

Inspect fuel control throttle rigging. TM 55-2840-256-23, task 7-2-1. Repair/adjust as necessary, TM 55-2840-256-23, task 4-6-1.

Return to service

No

Idle OK? Yes

Inspection fuel control idle speed stop setting, TM 55-2840-256-23, task 7-2-10.

Repair necessary? Yes

Idle OK? No

Replace fuel control. TM 55-2840-256-23, task 7-2-11, 7-2-12.
RG-6. FUEL AND/OR OIL LEAKING FROM FUEL PUMP/FUEL CONTROL OVERBOARD DRAIN PORTS.

FUEL LEAKAGE FROM THE FUEL CONTROL SEAL DRAIN IS PERMISSIBLE UP TO TEN DROPS PER MINUTE. EXCESSIVE FUEL LEAKAGE IS CAUSED BY A FAULTY FUEL PUMP TO FUEL CONTROL DRIVE SHAFT SEAL. OIL LEAKAGE IS CAUSED BY A FAULTY GEARBOX TO FUEL PUMP SEAL. THE FUEL CONTROL DRAIN (FUEL) AND THE FUEL PUMP DRAIN (OIL) ARE BOTH CONNECTED TO THIS COMMON DRAIN PORT.

START HERE: Start and run the engine at ground idle (63-65% Ng) with the boost pump ON. Determine whether the leak is fuel or oil and, if fuel, determine the leakage rate in DROPS PER MINUTE.

OIL?  
Yes -> Replace the fuel pump accessory drive seal in the accessory gearbox. TM 55-2840-256-23, task 6-4-1.
No -> THE FUEL CONTROL DRIVE SHAFT BEARINGS ARE PACKED WITH A GREASE CONTAINING A VERY DISTINCTIVE BLUE DYE. A FUEL LEAK INTO THE FUEL CONTROL DRIVE SHAFT AREA WILL WASH THE GREASE FROM THE BEARINGS AND MAY RESULT IN A FUEL CONTROL FAILURE.

Leak corrected?  
Yes -> IS IT BLUE?  
Yes -> REPLACE THE FUEL PUMP, TM 55-2840-256-23, tasks 7-3-1, 7-3-3, AND THE FUEL CONTROL tasks 7-2-11, 7-2-12.
No -> Exceeds limits?  
Yes -> Replace fuel pump TM 55-2840-256-23, tasks 7-3-1, 7-3-3.
No -> Return to service.

Return to service
This is usually caused by an improperly sized vent orifice. However a leaking breather gearshaft lip seal can also be the cause.

The compressor diffuser vent system consists of a two piece flanged tube, with a slip joint, which connects between the compressor diffuser and the exhaust collector. A size selected orifice is located at the exhaust collector end and controls vent system pressure. If vent pressure is too low, oil can leak past the compressor rear inner labyrinth seal or past the No. 5 labyrinth seal and into the exhaust collector. If vent pressure is too high it will cause oil to be blown overboard through the AGB breather vent. OIL SPEWING OR SEEping FROM THE DIFFUSER VENT ORIFICE OR TUBING JOINTS INDICATES THAT VENT PRESSURE MAY BE TOO HIGH.

Inspect the vent orifice and replace or re-size as necessary. TM 55-2840-256-23, task 3-5-1, 3-5-2. VENT PRESSURE MUST BE AT LEAST 0.8 IN. Hg AT GROUND IDLE AND NOT MORE THAN 10.0 IN. Hg AT TAKEOFF POWER. Replace vent orifice with progressively smaller sizes until vent pressure is near its lowest limit.

Replace breather gearshaft lip seal, TM 55-2840-256-23, task 6-1-4. This also requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2; compressor module removal/reinstallation, TM 55-2840-256-23, tasks 3-1-1, 3-1-2; and turbine module removal/reinstallation, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. Ground run engine to check.

Fault corrected?

No

Yes

Return to service
RG-8 UNABLE TO STOP ENGINE WITH FUEL CONTROL THROTTLE MOVEMENT TO CUT OFF

THIS MAY BE CAUSED BY: Fuel control throttle rigging or security. Separation of the throttle to cut off valve linkage on the fuel control. Fuel control cut off valve internal failure.

START HERE. Inspect fuel control throttle rigging, TM 55-2840-256-23, task 7-2-1. Adjust as necessary, TM 55-1520-248-23, tasks 4-6-1 through 4-6-8.

Adjustment necessary? Yes →

Engine stops OK? No →

Inspect fuel control cut off valve, TM 55-2840-256-23, task 7-2-6.

Engine stops OK? Yes →

Replace fuel control TM 55-2840-256-23, tasks 7-2-11, 7-2-12. No →

Return to service
IF LEAKAGE FROM ANY OF THE DRIVE SEALS IS HIGH ENOUGH TO INFLUENCE ENGINE OIL CONSUMPTION OR TO CAUSE OIL WETNESS ON ENGINE OR ACCESSORY EXTERIOR SURFACES, ALL EXCEPT THE AGB BREATHER GEAR SEAL CAN BE REPLACED WITHOUT REMOVING THE ENGINE.

THESE SEALS ARE:
- Np output, front
- Np output, rear
- Ng starter generator drive
- Ng tachometer drive
- Np tachometer drive
- Ng spare drive, front
- Np spare drive, rear
- Ng fuel pump/fuel control
- PMA drive
- AGB breather gear

If Np out, front or rear, leaking?

Ref. TM 55-2840-256-23 task 6-1-4 for identification and location of these seals. These seals leaking will usually cause an increase in transmission oil level. Visual indications are obscured by the free wheeling unit. Replace these seals, TM 55-1520-248-23, task 4-1-8. This also requires: Forward fairing removal/reinstallation, task 2-1-21. Air induction cowl removal/reinstall, tasks 4-2-1, 4-2-3. Engine to transmission drive shaft removal/reinstall, task 6-2-2. Forward tail rotor assy drive shaft removal/reinstall, task 6-6-1. Freewheeling unit removal/reinstall, task 6-5-1, 6-5-7. AC generator assembly removal/reinstallation, tasks 9-4-8, 9-4-9.
Remove the accessory mounted on the spare drive IAW the applicable task in TM 55-1520-248-23. Replace the tach or spare drive lip seal, TM 55-2840-256-23, task 6-4-1. Reinstall the removed accessory. Run engine to verify leak corrected.

Return to service
RGF-1. ENGINE UNSTABLE IN POWER RANGE.


START HERE: Check for electronic supervisory control fault code on the cockpit control panel. TM 55-1520-23 M.T.F. Section B-5. Clear all faults indicated.

- Repair necessary?
  - Yes: Engine runs OK?
    - Yes: Inspect aircraft fuel system to make certain that all lines are open, free of obstruction and that pumps are running. Disconnect aircraft fuel supply tube at the fuel control inlet port. Connect a hose to the tube and route it to a bucket or similar container. Make sure the aircraft fuel shut off valve is fully open (lever fully forward). Turn fuel boost pumps ON. Verify that fuel is flowing into the bucket. Capture at least two gallons of fuel, then turn boost pumps OFF. Verify that fuel flow ceases. Check the fuel sample for evidence of water or other contaminant. Remove and replace the engine fuel filter element, TM 55-2840-256-23, task 7-5-7. Reconnect the fuel control fuel inlet tube and purge engine fuel system, TM 55-2840-256-23, task 7-1-1.
    - No: Engine runs OK?
      - Yes: Check fuel control throttle rigging. TM 55-2840-256-23, task 7-2-1. Adjust as necessary, TM 55-1520-248-23, task 4-6-1.
      - No: Adjustment necessary?
        - Yes: Engine runs OK?
        - No: Engine runs OK?
          - Yes: Return to service
          - No: Repair necessary?

- No: Engine runs OK?
  - Yes: Inspect fuel control air sensing tubes for leaks. TM 55-2840-256-23, task 7-2-4.
  - No: Return to service
RGF-1

Repair necessary? Yes

Engine runs OK?

Replace compressor bleed valve (T703-AD-700B engine only) TM 55-2840-256-23, tasks 9-4-1, 9-4-2.

Replace fuel control, TM 55-2840-256-23, task 7-2-11, 7-2-12.

Does increasing or decreasing power (collective pitch) result in more stable operation?

No


Engine runs OK?

Replace AC generator, TM 55-1520-246-23, task 9-4-8, 9-4-9.

Yes

Engine runs OK?

Check aircraft electrical system. TM 55-1520-248-23, task 9-1-19.

Repair necessary? Yes

Engine runs OK?

No

Return to service
RGF-2. COMRESSOR SURGES DURING ACCELERATION FROM IDLE TO GOVERNING AT 100% Ng.

This may be caused by: Compressor damage or degradation. Compressor inlet blockage. Pressure-thermal distortion. Bleed valve closing too soon or stuck closed (T703-AD-700B engine only). Gas generator 1st stage nozzle area reduced by blockage from ingested sand and dust deposits. Fuel control. Electronic supervisory control.

START HERE: Check for electronic supervisory control faults on the cockpit control panel. TM 55-1520-248-23 M.T.F. Section B-5. Clear all faults recorded.

- Repair necessary?
  - Yes
  - No
  - No

- Acceleration OK?
  - Yes
  - No

Set electronic supervisory control switch to BACKUP. If this corrects the problem, replace electronic supervisory control, TM 55-1520-248-23, task 9-7-2, 9-7-3.

- Acceleration OK?
  - Yes
  - No

- Repair necessary?
  - Yes
  - No

Inspect compressor rotor for foreign object damage or erosion. TM 55-2840-256-25, task 3-6-1.

- Repair necessary?
  - Yes
  - No

- Acceleration OK?
  - Yes
  - No

Check collective pitch lever rigging TM 55-1520-248-23. Adjust as necessary.

- Yes
  - Adjustment necessary?
    - Yes
    - No
    - No


- Repair necessary?
  - Yes
  - No

Replace compressor bleed valve. (T703-AD-700B engine only) TM 55-2840-256-23, task 9-4-1, 9-4-2.

- Acceleration OK?
  - Yes
  - No

Replace fuel control. TM 55-2840-256-23, task 7-2-11, 7-2-12.

Return to service
THIS MAY BE CAUSED BY: Engine mount looseness. Engine alignment. Main rotor or tail rotor drive systems. Damage or failure of compressor rotor. GGT or PT rotor. Main or AGB bearings. GG or PT rotor unbalance. Gear failure. Gear tooth match. Accessory unbalance.

START HERE: Perform vibration tests IAW TM 55-2840-256-23, Section 9, procedure 1-37.1.

Inspect engine mounts and engine to transmission alignment, TM 55-1520-248-23, task 4-7-1 through 4-7-3.

Repair necessary?  Yes

Fault corrected?  Yes

Inspect main rotor and tail rotor drive systems for integrity, balance, and alignment, TM 55-1520-248-23, task 8-2-3.

Fault corrected?  Yes

Inspect compressor, TM 55-2840-256-23, task 3-1-1 thru 3-6-4.

Fault corrected?  Yes

Yes

Repair necessary?  Yes

RGF 3A

Fault corrected?  Yes

No

Yes

Repair necessary?  Yes

Inspect turbine assembly, TM 55-2840-256-23, Section 5.

Repair necessary?  Yes

Yes

Fault corrected?  Yes

RGF 3A this page

Fault corrected?  Yes

No


Fault corrected?  Yes

Check gearbox. TM 55-2840-256-23, Chapter 6.

Fault corrected?  Yes

Repair necessary?  Yes

Replace AC generator. TM 55-1520-248-23, task 9-4-8, 9-4-9.

Fault corrected?  Yes

No

Yes

Replace engine, TM 55-1520-248-23, task 4-1-1, 4-1-2.

No

Page 29 of 63
This may be caused by: Combustion liner damage. Turbine damage. Compressor damage. Fuel nozzle.

START HERE. Inspect fuel nozzle and check nozzle flow pattern. TM 55-2840-256-23, task 7-4-2, 7-4-3.

Repair necessary?
Yes

Fault corrected?
No

No

Fault corrected?
Yes

Replace engine. TM 55-1520-248-23, task 4-1-1, 4-1-2.

Remove and inspect combustion liner. TM 55-2840-256-23, tasks 4-1-2 or 4-1-4 and 4-3-1.

Repair necessary?
Yes

Fault corrected?
No

No

Inspect 1st stage turbine nozzle shield, nozzle, and turbine wheel. TM 55-2840-256-23, task 5-1-2, 5-1-3.

Repair necessary?
Yes

Fault corrected?
No

No

Inspect compressor rotor. Replace compressor module if necessary. TM 55-2840-256-23, task 3-1-1, 3-1-2.

Return to service
This may be caused by: Fuel control throttle rigging or security. Speed measurement/indicating systems error. Engine wiring harness. Aircraft to engine wiring harness. Extreme flight maneuver. Output load loss. Fuel control failure. Electronic supervisory control.

START HERE: Check for electronic supervisory control fault code on cockpit control panel. TM 55-1520-248-23 M.T.F. Section B-5 Clear all faults indicated.

- Repair necessary? Yes
  - Fault corrected?
    - Yes
    - No
  - No

- Set electronic supervisory control switch to BACKUP. If this corrects the problem, replace electronic supervisory control, TM 55-1520-248-23, task 9-7-2, 9-7-3.

- Fault corrected?
  - Yes
  - No

- Check fuel control throttle rigging. TM 55-2840-256-23, task 7-2-1. Adjust as necessary. TM 55-1520-248-23, task 4-6-1.

- Repair necessary?
  - Yes
  - Fault corrected?
    - Yes
    - No
  - No

- Test engine electrical wiring harness. TM 55-2840-256-23, task 8-1-1.

- Repair necessary?
  - Yes
  - Fault corrected?
    - Yes
    - No
  - No

- Test Ng and/or Ng speed pickup. TM 55-2840-256-23, task 8-6-2, 8-7-2, or 8-6-3, 8-7-3.

- Repair necessary?
  - Yes
  - Fault corrected?
    - Yes
    - No
  - No

- Replace fuel control. TM 55-2840-256-23, task 7-2-11, 7-2-12.

- Perform operational check of engine rotor and transmission instruments. TM 55-1520-248-23, task 8-1-1. Repair as necessary.

- Return to service

Rev. 11 Jul 99
RGF-6 EXCESSIVE EXHAUST TORCHING DURING TRANSIENTS. Page 1 of 1


Fault corrected?

Yes

No

Inspect fuel nozzle flow pattern, TM 55-2840-256-23, task 7-4-2, 7-4-3.

Repair necessary?

Yes

No

Fault corrected?

Replace fuel control, TM 55-2840-256-23, task 7-2-11, 7-2-12.

Fault corrected?

Yes

Return to service

No

Confirm description of reported problem. Re-address according to re-defined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.

START HERE: With the engine running at ground idle, turn anti-icing switch ON. Leak check the anti-icing air system plumbing with soap solution. TM 55-2840-256-23, task 9-1-1.

- Repair necessary?
  - Yes → Fault corrected?
    - Yes → Retest anti-icing system, TM 55-2840-256-23, task 9-1-2.
    - No → With the engine running at flight idle (100% Nr, rotor at flat pitch) test the anti-icing air system, TM 55-2840-256-23, task 9-1-2. If necessary, replace the anti-icing solenoid valve, tasks 9-2-1, 9-2-2 and/or the anti-icing air valve, tasks 9-3-1, 9-3-2.
  - No → Fault corrected?
    - Yes → Return to service
    - No → If A/I system tests (task 9-1-2) indicate an electrical problem, shut down the engine and, with power ON, check for 14-28 volts between pin U (hot) and pin T (grnd) on aircraft connector P16 (at accessory harness connector J16). If no voltage, troubleshoot the aircraft electrical circuitry, TM 55-1520-248-23, Appendix K, Section IV.

- Repair necessary?
  - Yes → Fault corrected?
    - Yes →
    - No →
RGF-8 MAGNETIC PLUG WARNING.

THIS IS INDICATION OF ENGINE METAL GENERATION WHICH MUST BE IDENTIFIED AND CORRECTED.

Scavenge oil from the accessory gearbox plus the oil flowing from the No. 2 bearing, the No. 2 1/2 bearing and the Nos. 3, 4, and 5 bearings flows past the LOWER chip detector. Oil flowing past the UPPER chip detector includes all oil scavenged from the engine, including that which has already flowed past the LOWER chip detector plus the oil from the Nos. 1, 6, No. 7, and No. 8 bearings. The chip detectors are NON fuzz burning and are connected through the engine accessory harness to the aircraft electrical harness and to the MFD in the cockpit.

Remove and service chip detector(s) TM 55-2840-256-23, tasks 6-3-1 through 6-3-6. Make log book entry "FALSE INDICATION"

Return to service

Remove chip detectors, TM 55-2840-256-23, tasks 6-3-1, 6-3-2. Inspect chip detectors, task 6-3-3, step 1.

Four chip lights in last 50 hours?

Yes

Particle size or count exceeds limits?

No

RF-8A

No

RF-8A

Yes

RF-8A this page

Replace engine, TM 55-1520-248-23, tasks 4-1-1, 4-1-2. Service aircraft portion of engine oil system, TM 55-2840-256-23, task 6-3-3, Step 1, part d (1) or d (2). (Ref. task 1-8-1)

Replace engine accessory harness TM 2840-256-23 (Similar procedure to tasks 8-1-2, 8-1-3)

Page 34 of 63

When a chip detector CAUTION is illuminated: 1. Disconnect engine accessory harness connector from the chip detector(s) giving chip indication.

Chip light turns OFF?

Yes

Disconnect aircraft interface connector P16 from the engine accessory harness connector J16.

No

Chip light turns OFF?

Yes

Troubleshoot aircraft wiring TM 55-1520-248-23, Appendix K, Section IV.

No

Remove, service, and re-install chip detectors, TM 55-2840-256-23, tasks 6-3-4 through 6-3-6. Ground run engine, task 6-3-3. Step 5.a. Return to service or replace engine as dictated by these procedures. Service aircraft portion of engine oil system, task 1-8-1.

Check the cockpit control panel (MFD) for engine torque system faults. TM 55-1520-248-23, M.T.F. Section B-5. Clear all faults recorded.

Repair necessary? Yes →

With engine running at ground idle, bleed the torquemeter system by loosening the fittings at Torquemeter transducer. Bleed until solid oil flows, then tighten. Increase power to "light on Skids."

No →

Tq Indication OK? Yes →

Troubleshoot engine electrical harness, TM 55-2840-256-23, tasks 8-1-1 through 8-1-3.

No →

Troubleshoot aircraft wiring to cockpit torque indicator, TM 55-1520-248-23, Appendix K, Section IV. If no problem with wiring, replace cockpit Tq indicator, TM 55-1520-248-23, task 8-1-9.

Check engine main oil pressure.

Oil pressure too low? Yes →

Correct IAW Troubleshooting procedure RGF-12, (page 44).

No →

Indicated Tq OK? Yes →

Replace aircraft Tq meter transducer, TM 55-1520-248-23, task 4-1-4.

No →

Run engine at ground idle (63 - 65% Ng) and observe indicated torque.

Indicated Tq OK? Yes →


No →

Return to service

Page 35 of 63
RGF-10 CONTINUOUS EXHAUST SMOKING.


Inspect the turbine exhaust collector for wetness, oil puddling, and/or drain blockage. If oil is present, visually determine if it is a puddle from exhaust collector hub fairing (No. 5 labyrinth seal), or from the compressor rear seal vent (forward left side of exhaust collector), or accessory gearbox breather vent (forward right side of exhaust collector).

Oil in exh. collector?  
Yes  

Remove air induction cowl, TM 1520-248-23, task 4-2-1. Inspect compressor inlet for oil wetting of impeller or on inside of shroud. Inspect the inlet for looseness of impeller at No. 1 bearing area, for damage to inlet guide vanes or impeller vanes, or for rub or erosion of shroud lining in vicinity of impeller vane tips.

No  

No

Repair necessary  
Yes

Smoking eliminated?  

Smoke scavenging flow check OK?  
Yes  

No

Check aircraft scavenge return system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, oil tank vent line, etc)

Smoking eliminated?

No

Repair necessary  
Yes

No

Inspect oil transfer tubes, oil check valve, and oil filter housing, TM 55-2840-256-23, tasks 6-2-3, 6-2-4. If there is wear in the transfer tube bore in the GEARBOX HOUSING, replace the accessory gearbox module, TM 55-2840-256-23, tasks 6-1-2, 6-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2 and Compressor and Turbine module removal/reinstallation, tasks 3-1-1, 3-1-2, 5-1-2, 5-1-3. Check and adjust main oil pressure, tasks 1-8-12 and 6-2-9.

RGF-10A next page

RGF-10B next page

Page 36 of 63
Collector obstructed?  
No  
Yes  
Smoking eliminated?  
No  
Yes  
Puddling from 45 seal?  
No  
Yes  
Wetness from comp. seal vent?  
No  
Yes  
Replace breather gearshaft lip seal, TM 55-2840-256-23, task 6-1-4. This requires: (1) Engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2; (2) Compressor module removal/reinstallation, TM 55-2840-256-23, tasks 3-1-1, 3-1-2; (3) Turbine module removal/reinstallation, TM 55-2840-256-23, tasks 5-1-2, 5-1-3.

Make sure compressor seal vent orifice is properly seated.

Was seated?  
No  
Yes  
Replace compressor module, TM 55-121840-256-23, tasks 3-1-1, 3-1-2. This requires removal and reinstallation of the engine, TM 1520-248-23, tasks 4-1-1, 4-1-2, and removal/reinstallation of the turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. SERVICE ENGINE OIL SYSTEM, TM 55-2640-256-23, task 1.8.1. PERFORM ALL RELATED MAINTENANCE ACTIONS REQUIRED BY: TM 55-2840-256-23, tasks 6-6-2, 6-2-10, 6-2-13, 6-3-1 through 6-3-4, 3-4-1 through 3-4-3, 3-5-1 and 3-5-2. AND THOSE REQUIRED BY TM 55-1520-248-23, tasks 1-4-5, 1-4-5.1, 4-4-2, and 4-4-17.

Replace power turbine module, TM 55-2840-256-23, tasks 5-1-1, 5-1-2. This requires engine removal and reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2, and combustor module installation, TM 55-2480-256-23, task 4-1-5.

Repair necessary?  
No  
Yes  
Smoking eliminated?  
No  
Yes  
Return to service
RGF-11 OIL SPEWING OR LEAKING FROM GEARBOX VENT AND/OR TUBING JOINTS.

THIS MAY BE CAUSED BY: AGB breather gearshaft lip seal leakage. High gearbox pressure caused by diffuser vent orifice too small or damaged. Worn or damaged turbine seals in the cooling air or pressure balance circuits.

The AGB overboard vent system consists of a breather gear acting as an air/oil separator. Vented air is routed through an internal passage in the gearbox to a fitting which connects to a two-piece, O-ring sealed, slip joint tube, which in turn connects to a flanged, gasket sealed, fitting at the front of the turbine exhaust collector, and into the exhaust stream.

- **Oil entering exhaust collector from breather vent?**
  - Yes → **Oil consumption rate within limits?**
    - Yes → Oil still coming from breather vent?
      - No → Repair as necessary, TM 55-2840-256-23, task 5-1-3 steps 23 through 27. Ground run engine to check.
    - No → Heavy or continuous exhaust smoking?
      - Yes → Orifice size change necessary?
        - Yes → Oil still coming from breather vent?
          - Yes → Replace turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2.
          - No → Check diffuser vent pressure. Resize vent orifice as necessary, TM 55-2840-256-23, tasks 3-5-1, 3-5-2.
        - No → Oil still coming from breather vent?
          - No → Oil still coming from diffuser vent?
            - Yes → Replace turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2.
            - No → Return to service

- No → External leakage from breather vent tube or fittings?
  - Yes → Repair as necessary, TM 55-2840-256-23, task 5-1-3 steps 23 through 27. Ground run engine to check.
  - No → Oil consumption rate within limits?
    - Yes → Oil still coming from breather vent?
      - No → Oil still coming from diffuser vent?
        - Yes → Replace turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2.
        - No → Return to service

DO NOT MASK OIL SYSTEM PROBLEMS WHICH OCCUR SUDDENLY AND FOR NO OBVIOUS REASON ON AN ENGINE IN SERVICE BY ADJUSTING THE OIL PRESSURE REGULATOR. Visually inspect the engine, lube system, and drains for external leakage. Tighten tube fittings, hose fittings, etc. Replace components as necessary, TM 55-1520-248-23, tasks 4-4-4 through 4-4-8, 4-4-9, and 4-4-18.

Oil pressure OK?  Yes

Repair necessary?  No  Yes

Check oil level in tank. Replenish if necessary, TM 55-1520-248-23, task 1-4-5.1.

More than two quarts needed?  No  Yes

Oil pressure OK?  No  Yes

RGF-12A this page

Check engine oil pressure transducer with a direct reading gage. TM 55-1520-248-23, task 4-1-3.

RGF-12A

Troubleshoot, repair, or replace main oil pressure channel of Multiparameter Display unit, TM 1520-248-23, Appendix K, Section III and tasks 8-1-5 through 8-1-8. Run engine as required to verify satisfactory oil pressure.

Oil pressure OK?  Yes

Service engine oil system, TM 55-2840-256-23, task 1-4-5.
PERFORM ALL RELATED MAINTENANCE REQUIREMENTS FOR: OIL TANK; OIL FILTER; OIL FILTER HOUSING; CHUTE DETECTORS; OIL PRESSURE TRANSDUCER; TM 55-1520-248-23, TASKS 1-4-5 AND 4-4-2, AND TM 55-2840-256-23, TASKS 6-2-2, 6-2-10 THROUGH 6-2-13, 6-3-1 THROUGH 6-3-4, 3-4-1 THROUGH 3-4-3. FLUSH AIRCRAFT OIL LINES AND OIL COOLER. Replace scavenging oil filter element, TM 55-1520-248-23, task 4-4-7.

Oil pressure OK?  No  Yes

RGF-12B next page

Return to service

Page 39 of 53
RGF-12B

Oil pressure OK? Yes

Perform slow engine acceleration from ground idle (63-65% Ng) to 100% Np, rotor at flat pitch.

No

Return to service

Yes

Low oil pressure may be caused by high oil temperature. Is oil pressure below limits at oil temperature below 225 Deg. F.(107 Deg. C)? If so, abort run. Do not wait for oil temp. to stabilize in order to minimize time at low oil pressure.

No

Adjust oil pressure regulating valve, TM 55-2840-256-23, task 6-2-9.

Yes

Does oil pressure increase with Ng increase?

No

Low oil pressure at less than 225 Deg. F (107 Deg. C)?

Adjusts OK?

No

Remove and inspect oil pressure regulator valve assembly, TM 55-2840-256-23, tasks 6-2-5 through 6-2-8. Adjust as necessary, task 6-2-9.

Yes

Adjusts to limits OK?

No

Remove oil filter housing and check valve assembly, TM 55-2840-256-23, task 6-2-3. Check O ring lands on transfer tubes and bores in filter housing and AGB housing (where transfer tubes and check valve are inserted) for wear. Replace tubes, check valve or filter housing where wear is noted.

Yes

Wear in AGB housing bore(s)?

No

Replace accessory gearbox, TM 55-2840-256-23, tasks 6-1-2, 6-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-4-1, 4-1-2, and removal/reinstallation of compressor and turbine modules, tasks 3-1-1, 3-1-2, 5-1-2, 5-1-3.

Yes

Service engine oil system, TM 55-1520-248-23, task 1-4-6.1.

Return to service

Oil pressure OK?

Page 40 of 63
RGF-13 HIGH OIL PRESSURE.

This may be caused by: Oil pressure measurement system. Oil passage obstruction in AGB. Turbine oil supply restriction.

Do not mask oil system problems which occur suddenly and for no obvious reason on an engine in service by adjusting the oil pressure regulator. Note: Oil pressure may be expected to be temporarily high immediately after start during cold weather operation.

Check the engine oil pressure transducer, TM 55-1520-348-23, task 4-1-3.

High oil pressure confirmed?

Was engine newly installed?

Were parts changes affecting oil pressure just made?

Adjust oil pressure regulating valve, TM 55-2840-256-23, task 6-2-9.

Troubleshoot, repair, or replace main oil pressure channel of Multiparameter Display unit, TM 55-1520-248-23, Appendix K, Section III and tasks 8-1-5 through 8-1-8. Run engine as required to verify satisfactory oil pressure.

Oil pressure indication OK?

Replace oil pressure transducer, TM 55-1520-248-23, task 4-1-4.

Oil pressure indication OK?


Return to service
RGF-14 OIL PRESSURE DROPS OFF SEVERELY WITH NORMAL OIL TEMPERATURE.

THIS MAY BE CAUSED BY: Oil level. Pressure measurement system. Oil pressure regulator. Degraded oil pump. Oil transfer tubes. Aircraft oil system flow restriction. Oil foaming.

Check oil level in tank. Replenish if necessary, TM 55-1520-248-23, task 1-4-5.1.

More than two quarts needed?

Yes

Oil pressure OK?

No

Check the oil pressure transducer, TM 55-1520-248-23, task 4-1-3. Replace if necessary, task 4-1-4.

Transducer replaced?

Yes

Oil pressure OK?

No

Check the oil pressure regulator, TM 55-2840-256-23, task 6-2-5, 6-2-6. Repair and/or adjust as needed, tasks 6-2-7, 6-2-8. Run engine at 100% NP, rotor at flet pitch until oil temperature stabilizes. Verify that oil pressure does not decrease as oil warms.

Oil pressure drops as oil warms?

Yes

Return to service

No

Troubleshoot, repair, or replace main oil pressure channel of Multiparameter Display unit, TM 55-1520-48-23, Appendix K, Section III, and tasks 8-1-5 through 8-1-8. Run engine as required to verify satisfactory oil pressure.

Adjust oil pressure regulator, TM 55-2840-256-23, task 6-2-9.

Return to service

No

Remove oil filter housing and check valve assembly, TM 55-2840-256-23, task 6-2-3. Check O ring lands on transfer tubes and AGB housing (where transfer tubes and check valve are inserted) for wear. Replace tubes, check valve or filter housing where wear is noted.

Wear in AGB housing bores?

Yes

Reinstall oil filter housing and check valve assembly, TM 55-2840-256-23e, task 6-2-4.

No

Replace AGB module, TM 55-2840-256-23, tasks 6-1-2, 6-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2, and compressor and turbine removal/reinstallation, TM 55-2840-256-23, tasks 3-1-1, 3-1-2, 5-1-2, 5-1-3.

Service engine oil system, TM 55-2840-256-234, tasks 1-8-1, 6-2-10 through 6-2-13, 6-2-2, 6-3-1 through 6-3-4, 3-4-1, 3-4-3, and TM 55-1520-248-23, tasks 1-4-5 and 4-4-2. Replace scavenge oil filter element, TM 55-1520-2480-23, tasks 4-4-17 and 1-4-5.1.

Page 42 of 63
RGF-15 Oil temperature exceeds 107 Degrees C. (225 Deg. F).

THIS MAY BE CAUSED BY: Oil temperature measurement system. Aircraft oil cooler, cooler bypass, or thermostat. Cooling fan damaged or obstructed.

- Oil temperature exceeds 120 Deg. C (248 Deg. F)?
  - Yes: Replace engine, TM 55-1520-248-23, tasks 4-1-1, 4-1-2.
  - No:
    - Oil temp. is between 107 Deg. C. and 120 Deg. C (225-248 Deg. F) for less than ten minutes?
      - Yes:
        - Check calibration of oil temperature measurement system, TM 55-1520-248-23, task 1-4-5, 4-4-6, 9-3-10.
        - Calibration OK?
          - Yes: Check oil cooler blower inlet and oil cooler outlet duct for obstruction. If no obstruction, perform oil cooler bypass valve functional check, TM 55-1520-248-23, task 4-4-8, 4-4-10. If oil cooler bypass valve is OK, check, clean, and/or replace oil temp. control valve, TM 55-1520-248-23, tasks 6-8-20, 6-8-21. If oil cooler temperature control valve is OK, check oil cooler, TM 55-1520-248-23, tasks 6-8-22 through 6-8-24.
          - No:
            - Has main oil pressure been below limits since oil overtemp?
              - Yes: Replace oil filter housing assembly, TM 55-2840-256-23, task 6-2-4. Flush aircraft oil lines and oil cooler, Replace scavange oil filter element, TM 55-1520-248-23, task 4-4-17. Service engine oil system, TM 55-1520-248-23, task 1-4-5.1.
              - No: Carbon particles found in oil filter?
                - Yes:
                  - Service power turbine pressure oil fitting, screen and nozzle, TM 55-2840-256-23, task 1-8-4. Service power turbine scavenge strut, task 1-8-6. Measure oil flow from power turbine strut, task 1-8-9.
                  - No:
                    - Troubleshoot, repair, or replace main oil pressure channel of Multiparameter Display unit, TM 55-1520-248-23, Appendix K, Section III, and tasks 8-1-5 through 8-1-8.
              - No:
                - Oil temperature OK?
                  - Yes: Service engine oil system, TM 55-2840-256-23, task 1-8-1. Perform all related maintenance requirements, TM 55-1520-248-23, tasks 1-4-5, 4-4-2, and TM 55-2840-256-23, tasks 6-2-2, 6-2-10 through 6-2-13, 6-3-1 through 6-3-4, 3-4-1 through 3-4-3.
                  - No: Return to service.

Page 43 of 63
Run engine for ten minutes at "light on skids" power.
Reinspect/clean:
- Oil filter, TM 55-2840-256-23, tasks 6-2-9 through 6-2-13.
- Magnetic chip detectors, tasks 6-3-1 through 6-3-4.
If carbon particles found in oil filter, service power turbine pressure oil fitting, screen, and nozzle, TM 55-2840-256-23, task 1-8-4. Measure oil flow from scavenge oil strut, task 1-8-9.

Return to service.
NOTE: Reinspection of oil filter and magnetic chip detectors is required after five hours of operation.

Carbon particles found on reinspection?

Yes

Service power turbine pressure oil fitting, screen and nozzle, TM 55-2840-256-23, task 1-8-4. Service power turbine scavenge strut, TM 55-2840-256-23, task 1-8-6. Measure oil flow from scavenge strut, task 1-8-9.

Return to service.

No
RGF-16  EXCESSIVE OIL PRESSURE FLUCTUATION.


- Check oil level in tank.  Replenish if necessary, TM 55-1520-248-23, task 1-4-5.1.
  - More than two quarts needed?
    - Yes
      - Oil pressure stable?
        - Yes
          - Troubleshoot, repair, or replace main oil pressure channel of Multiparameter Display unit, TM 55-1520-248-23, Appendix K, Section III, and tasks 8-1-5 through 8-1-8.  Run engine as required to verify satisfactory operation.
        - No
          - Remove/inspect/repair, oil pressure regulating valve assembly, TM 55-2840-256-23, tasks 6-2-5 through 6-2-8.
    - No
      - Bleed main oil pressure transducer line by loosening fitting at the transducer.  Motor the engine with the starter until solid oil flows from fitting.  Tighten fitting while engine is still motoring and oil is flowing.
- Oil pressure stable?
  - Yes
    - Return to service
  - No
    - Check engine oil pressure transducer, TM 55-1520-248-23, task 4-1-3.
      - Oil pressure stable on direct reading gage?
        - Yes
          - Replace scavange oil filter element, TM 55-1520-248-23, task 4-4-17.  Service engine oil system, Task 1-4-5.1.
        - No
          - Oil pressure stable?
            - Yes
              - Replace AGB module, TM 55-2840-256-23, task 6-1-2, 6-1-3.  This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2, compressor module and turbine module removal/reinstallation, TM 55-2840-256-23, tasks 3-1-1, 3-1-2, 5-1-2, 5-1-3.
            - No
              - Return to service
      - Oil pressure stable?
        - Yes
          - Replace oil pressure transducer, TM 55-1520-248-23, task 4-1-4.  Bleed transducer and line.
        - No
          - Return to service
Transfer of oil from the aircraft transmission oil system to the engine oil system can occur at the interface between the engine AGB front output drive and the free wheeling unit (FWU) or at the rear AGB power takeoff (tail rotor drive shaft aft bearing and seal cap). The engine and transmission oil systems are isolated from each other by lip seals at the AGB front and rear output drives. Seal leakage or inadequate scavenging of the FWU can allow entry of transmission oil into the engine oil system.

Inspect the oil return line from the FWU to the transmission for sharp bends, kinks, or obstructions that could restrict scavenging oil flow from the FWU. Repair or replace as necessary.

Repair necessary?

Yes

No

Replace front and rear AGB output drive seals, TM 55-2840-256-23, task 6-1-4. This requires removal/reinstallation of the free wheeling unit, TM 55-1520-248-23, task 6-5-1, engine to transmission drive shaft, task 6-2-2, and forward tail rotor drive shaft, task 6-6-1.

Service engine oil system, TM 55-2840-256-23, task 1-4-5. PERFORM ALL RELATED MAINTENANCE REQUIREMENTS FOR: OIL TANK, OIL FILTER, OIL FILTER HOUSING, CHIP DETECTORS, OIL PRESSURE TRANSDUCER, TM 55-2840-256-23, tasks 1-4-5 and 4-4-2, and TM 55-1520-248-23, tasks 6-2-2, 6-2-10 through 6-2-13, 6-3-1 through 6-3-4, 3-4-1 through 3-4-3. FLUSH AIRCRAFT OIL LINES AND OIL COOLER. Replace scavenge oil filter element, TM 55-1520-248-23, task 4-4-17. Service engine oil system, task 1-4-5.1.

Ground run the engine for at least one hour at 100% Np to verify no transfer of oil between the transmission and engine.

Return to service
Drain and service transmission, FWU, and transmission oil filters, TM 55-1520-248-23, tasks 1-4-6, 1-4-6.1, and 6-8-3.

RGF-20B

Excessive oil wetness around breather outlet port?

No

Yes

Replace turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. This will require engine removal/reinst., TM 1520-248-23, task 4-1-1, 4-1-2.

Replace AGB module, TM 55-2840-256-23, tasks 6-1-2, 6-1-3. This will require engine removal/reinst., TM 55-1520-2840-23, tasks 4-1-1, 4-1-2, as well as removal/reinst. of compressor and turbine modules, TM 55-2840-256-23, tasks 3-1-1, 3-1-2, 5-1-2, 5-1-3.

Ground run engine at 100% Np for a minimum of one hour to verify no oil transfer between transmission and engine oil systems. Check diffuser vent orifice pressure, realign orifice if necessary, TM 55-2840-256-23, tasks 3-5-1, 3-5-2.

Drain and service transmission, FWU, and transmission oil filters, TM 55-1520-248-23, tasks 1-4-6, 1-4-6.1, and 6-8-3.

Return to service

START HERE, Inspect TGT, Torque, and Speed measurement/indicating systems, TM 55-1520-248-23. CHAPTER 8. Test and inspect the thermocouple assembly TM 55-2840-256-23, task 5-3-1, 5-3-3. Replace if necessary, task 5-3-2, 5-3-4.

Repair necessary?

Fault corrected?

Yes

Yes

Yes

Yes

Yes

Yes

Return to service

Confirms description of reported problem. Re-address according to redefined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2940-256-23.

Fault corrected?

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No

No


RF-2  LOW POWER WITH TGT BELOW MAXIMUM LIMIT.


Check for electronic supervisory control faults on the cockpit control panel, TM 55-1520-248-23 M.T.F. Section B-5. Clear all faults indicated.

- Repair necessary?
  - Yes
  - Fault corrected?
    - Yes
      - Set electronic supervisory control switch in BACKUP position. If this corrects the problem, replace electronic supervisory control, TM 55-1520-248-23, tasks 9-7-2, 9-7-3.
    - No
  - No

Check to make sure that fuel lines are open and unobstructed and that pumps are running. Disconnect aircraft fuel supply tube at the fuel control inlet port. Connect a hose to the tube and route it to a bucket or similar container. Make sure the aircraft fuel shut off valve is fully open (lever fully forward). Turn fuel boost switch ON. Verify that fuel is flowing into the bucket. Capture at least two gallons of fuel, then turn boost pumps OFF. Verify that fuel flow ceases. Check the fuel sample for evidence of water or other contaminant. Remove and replace engine fuel filter element TM 55-2840-256-23, task 7-5-7. Reconnect the fuel control fuel inlet tube and purge the engine fuel system, TM 55-2840-256-23, task 7-1-1.

- Repair necessary?
  - Yes
  - Fault corrected?
    - Yes
  - No

- Fault corrected?
  - Yes
    - Inspect fuel control air sensing tubes for leaks, obstructions, TM 55-2840-256-23, task 7-2-4, and Pc air filter, task 7-2-7.
  - No

Inspect fuel control throttle rigging, TM 55-2840-256-23, task 4-6-1.

- Repair necessary?
  - Yes
  - Fault corrected?
    - Yes
      - Replace fuel control, TM 55-2540-256-23, tasks 7-2-11, 7-2-12.
    - No
  - No

Return to service

Page 50
of 63

Rev. 11 Jul 99
RF-3 LOW MEASURED TGT AT NORMAL OR HIGH POWER.

THIS CAN BE CAUSED BY: TGT indicator, thermocouple, or harness. Engine electrical harness. Aircraft electrical harness. NOTE: IF THE ENGINE IS PRODUCING NORMAL POWER, THE FUEL CONTROL SYSTEM CANNOT CAUSE A TGT ERROR.

START HERE. Inspect TGT indicator, TM 1520-248-3, Chapter 8. Test and inspect thermocouple assembly, TM 55-2840-256-23, tasks 5-3-1, 5-3-3.

Repair necessary?

Yes ➔ Fault corrected?

No ➔ Repair necessary?

Yes ➔ Fault corrected?

No ➔ Inspect engine electrical harness, TM 55-2840-256-23, task 8-1-1.

Repair necessary?

Yes ➔ Fault corrected?

No ➔ Inspect aircraft electrical harness, TM 1520-248-23, task 9-1-19.

Repair necessary?

Yes ➔ Fault corrected?

No ➔ Confirm description of reported problem. Re-address according to redefined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.

Return to service
RF-4 SLOW TO ACCELERATE TO POWER - ROTOR DROOP WITH COLLECTIVE PITCH INCREASE.


START HERE: Check for electronic supervisory control faults on the cockpit control panel. TM 55-1520-248-23 M.T.F. Section B-5. Clear all faults indicated.

- Repair necessary? Yes → Fault corrected? No → Acceleration OK?

Troubleshoot the electrical system to determine cause of excessive load. TM 55-1520-248-23, Chapter 8, Section II through VIII

- Yes

Inspect compressor bleed valve (T703-AD-700B engine only) TM 55-2840-256-23, tasks 9-4-1, 9-4-2.

- Repair necessary?

- Fault corrected? Yes → Fault corrected? No → Acceleration OK?

Inspect compressor module for air leaks. TM 55-2840-256-23, Chapter 3. Inspect compressor discharge tubes and seals for leaks, tasks 4-4-2, 4-4-3, 4-4-4, 4-4-5.

- Yes

Repair necessary?

- Fault corrected? Yes → Acceleration OK?

Inspect fuel control air sensing tubes for leakage, TM 66-2840-256-23, task 7-2-4. Service Pc air filter, task 7-2-7.

- Repair necessary?

- Fault corrected? Yes → Return to service

Turn off all aircraft electrical systems not essential to engine operation.

RF-4 next page

Page 52

Rev. 11 Jul 99
Confirm description of reported problem. Re-address according to redefined description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.
RF-5 OIL CONSUMPTION EXCEEDS ONE QUART PER FIVE HOURS OF ENGINE OPERATION.

THIS MAY BE CAUSED BY: External leak, engine or aircraft. AGB lip seal leak. No. 1 seal leak. Turbine sump scavenge strut blockage or inadequate scavenging. High AGB case pressure. No. 5 labyrinth seal leak. Dirty scavenge filter.

Visually inspect the engine oil system and drains for evidence of leakage or venting.

Leakage or drainage noted? Yes

Inspected the exhaust collector flow path for the following

Compressor diffuser vent leaking? Yes

Inspect, (resize if necessary) diffuser vent orifice, TM 55-2840-256-23, tasks 3-5-1, 3-5-2.

No

Gearbox breather vent leaking? Yes

Replace breather gearshaft lip seal, TM 55-2840-256-23, task 6-1-4. This requires removal/reinstallation of the engine, TM 55-1520-248-23, tasks 4-1-1, 4-1-2, compressor module removal/reinstallation, TM 55-2840-256-23, tasks 3-1-1, 3-1-2, and turbine module removal/reinstallation, tasks 5-1-2, 5-1-3. Run engine to verify leakage has stopped.

No

No. 5 labyrinth seal leaking? Yes

Replace turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2. Check and adjust, if necessary, diffuser vent orifice, TM 55-2840-256-23, tasks 3-5-1, 3-5-2.

No

Return to service

Tighten loose tube fittings, hose fittings, etc, as necessary. Repair or replace components as necessary: OIL TANK, TM 55-1520-248-23, tasks 4-4-1 through 4-4-8. OIL COOLER BYPASS VALVE, task 4-4-9. OIL SCAVENGE FILTER: task 4-4-18. ACCESSORY DRIVE LIP SEALS, TM 55-2840-256-23, task 6-4-1. STARTER GENERATOR, TM 55-1520-248-23, task 9-3-15, OUTPUT DRIVE LIP SEALS, TM 55-1520-248-23, task 4-1-9. Run engine to verify leakage corrected.

Replace breather gearshaft lip seal, TM 55-2840-256-23, task 6-1-4. This requires removal/reinstallation of the engine, TM 55-1520-248-23, tasks 4-1-1, 4-1-2, compressor module removal/reinstallation, TM 55-2840-256-23, tasks 3-1-1, 3-1-2, and turbine module removal/reinstallation, tasks 5-1-2, 5-1-3. Run engine to verify leakage has stopped.

Remove air induction cowl, TM 55-1520-248-23, task 4-2-1. Inspect compressor inlet for oil wetting of impeller or on inside of shroud. Inspect the inlet for looseness of impeller at No. 1 bearing area for damage to inlet guide vanes or impeller vanes, or for rub or erosion of shroud lining in vicinity of impeller vane tips.

No

Return to service

RF-5A next page

Page 54 of 63
RF-5A

Oil wetting or impeller looseness noted?

Replace compressor module, TM 55-2480-256-23, task 3-1-1, 3-1-2. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2 and turbine module removal/reinstallation, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. Check and, if necessary, adjust diffuser vent pressure, TM 55-2840-256-23, tasks 3-5-1, 3-5-2.


Replace accessory gearbox module, TM 55-2840-256-23, tasks 6-1-2, 6-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2, as well as removal and reinstallation of compressor and turbine modules, tasks 3-1-1, 3-1-2, and 5-1-2, 5-1-3.

Scavenge oil flow measurement OK?

Return to service

Oil consumption OK?

Replace power turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2. Check and, if necessary, adjust diffuser vent pressure, TM 55-2840-256-23, tasks 3-5-1, 3-5-2.
OFF-1 BEARING NOISE AT COMPRESSOR WHICH MAY BE ACCOMPANIED
BY LOOSENESS OF THE IMPELLER.

THIS IS AN INDICATION OF A BEARING FAILURE.

Remove, inspect, service, and reinstall magnetic chip detectors, TM 55-2840-256-23, tasks 6-3-1 through 6-3-6.

Size and number of chips within limits?

No

Replace engine, TM 1520-248-23, tasks 4-1-1, 4-1-2.

Yes

Remove air induction cowling, TM 55-1520-248-23, task 4-2-1. Inspect the compressor inlet for indications of impeller vane tip rub or looseness in the No. 1 bearing area.

Rub or looseness noted?

No

Reinstall air induction cowling, TM 55-1520-248-23, task 4-2-3. Run engine at 100% Np, rotor at flat pitch, until oil temperature stabilizes. Cool down and shut down. Listen for compressor bearing noise during cooldown.

Yes

Bearing noise?

No

Return to service

Yes

Replace compressor module, TM 55-2840-256-23, tasks 3-1-1, 3-1-2. This requires engine removal/reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2, and turbine module removal/reinstallation, tasks 5-1-2, 5-1-3.

Service engine oil system, TM 55-2840-256-23, task 1-8-1. This includes the following: OIL TANK, Drain, inspect, TM-55-1520-248-23, tasks 1-4-5, 4-4-2.

ENGINE OIL FILTER, Remove, service, reinstall, TM 55-2840-256-23, tasks 6-2-10 through 6-2-13. OIL FILTER HOUSING ASSEMBLY, CLEAN, task 6-2-2.

MAGNETIC CHIP DETECTORS, Remove, inspect, service, tasks 6-3-1 through 6-3-4. Flush the No. 1 bearing scavenge oil line. If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer, TM 55-2840-256-23, tasks 3-4-1 through 3-4-3, and flush aircraft oil lines and oil cooler. Replace scavenge oil filter element, TM 55-1520-248-23, task 4-4-17. Service engine oil system, TM 55-1520-248-23, task 1-4-5.1.

Run engine as required to verify problem correction. Check diffuser vent pressure, TM 55-2840-256-23, tasks 3-5-1, 3-5-2.
OFF-2 ENGINE WILL NOT CRANK (STARTER UNABLE TO ROTATE ENGINE).

THIS MAY BE CAUSED BY: Insufficient voltage to the starter. Electrically failed or defective starter-generator. Binding of Compressor, Turbine, or Gearbox.

With power ON, ignition circuit breaker OUT and fuel control throttle (twist grip) in CUTOFF, energize the starter while noting battery voltage prior to starter engagement and starter voltage after engagement. Have an observer watching the starter cooling fan for rotation as the starter is engaged. Disengage starter after observing voltages and starter response.

- Starter rotation OK?
  - Yes
  - No
    - Did fan twitch and hang or starter buzz?
      - Yes
      - Return to service
      - No
      - Voltage indicated at starter?
        - Yes
        - Return to service
        - No
        - Troubleshoot and repair aircraft starter electrical system, TM 55-1520-248-23, Appendix K, Section IV.
          - Motor to verify engine rotation OK.

  - Drive shaft OK?
    - Yes
    - No
      - Insert engine turning tool into starter drive pad and rotate Ng gear train by hand to determine integrity of engagement between starter gear shaft and Ng rotor.
        - Gear shaft turns without Ng rotation?
          - Yes
          - Motors OK?
            - Yes
            - Replace engine, TM 55-1520-248-23, tasks 4-1-1, 4-1-2.
            - No
            - Return to service
          - No
          - Ng gear shaft does not turn?
            - Yes
            - Return to service
            - No
            - Replace accessory gearbox, TM 2840-256-23, task 6-1-2, 6-1-3. This requires engine removal/reinstallation, TM 1520-248-23, tasks 4-1-1, 4-1-2. Service engine oil system, TM 55-1520-248-23, tasks 1-4-5, 1-4-5.1 and TM 55-2840-256-23, task 1-6-1.

  - Amb. temp. above 32 Deg. F (0 Deg. C)?
    - Yes
    - Use heater to flow warm air through the engine to melt any ice present.
    - No
    - Return to service

Rev. 11 Jul 99
OFF-3 STARTER WILL NOT ROTATE ENGINE IMMEDIATELY AFTER SHUT DOWN.

Rub or binding of rotating components due to differential rate of cooling, or insufficient clearance.

- Allow engine to cool naturally (without motoring) to 150 Deg. C (302 Deg. F), maximum, then attempt a start.
  - Start OK?
    - Yes
      - Reinstall (or replace) 1st stage nozzle shield, TM 55-2840-256-23, task 5-1-1.
    - No
      - Replace turbine module, TM 55-2840-256-23, task 5-1-3.

- Remove compressor module, TM 55-2840-256-23, task 3-1-1, and inspect for freedom of rotation and absence of rub or mechanical damage. This requires engine removal and reinstallation, TM 55-1520-248-23, tasks 4-1-1, 4-1-2.
  - Compressor OK?
    - Yes
      - Install serviceable gearbox, TM 55-2840-256-23, tasks 6-1-2, 6-1-3.
    - No
      - Install compressor module, TM 55-2840-256-23, task 3-1-2. Install turbine module, task 5-1-3. Reinstall combustion module, task 4-1-3.

- Remove turbine module, TM 55-2840-256-23, task 5-1-2. Inspect Ng rotor for freedom of rotation.
  - No
    - Install serviceable compressor module, TM 55-2480-256-23, task 3-1-2.
  - Yes
OFF-4 STATIC OIL LEAKAGE FROM POWER AND ACCESSORY GEARBOX BREATHER.

THIS IS AN INDICATION THAT THE OIL FILTER CHECK VALVE IS LEAKING.

Remove the oil filter housing and check valve assembly. Replace the check valve and reinstall the oil filter housing and check valve assembly, TM 55-2840-255-23, tasks 6-2-3 and 6-2-4.

Return to service
OFF-5 FUEL LEAKING FROM THE FUEL CONTROL SEEP HOLES.
LEAKAGE MAY BE BLUE IN COLOR AND/OR BLUE STAIN MAY BE FOUND
ON THE LOWER EXTERNAL SURFACE OF THE FUEL CONTROL.

THIS IS AN INDICATION OF A LEAKING FUEL PUMP DRIVE SHAFT SEAL, OR FUEL PUMP
DRIVE O-RING LEAK.

NO LEAKAGE IS ALLOWED FROM THE FUEL
CONTROL WEEP HOLES, (TM 55-2840-256-23, TASK 7-
2-5). THE FUEL CONTROL DRIVE SHAFT BEARINGS
ARE PACKED WITH A GREASE CONTAINING A VERY
DISTINCTIVE BLUE DYE. A FUEL LEAK INTO THE
FUEL CONTROL DRIVE SHAFT AREA WILL WASH THE
GREASE FROM THE BEARINGS INTO THE FUEL
CONTROL DRIVE HOUSING CAVITY WHERE IT WILL
DRAIN OUT OF THE WEEP HOLES AND COLLECT ON
THE BOTTOM OUTSIDE SURFACE OF THE FUEL
CONTROL (DIRECTLY ABOVE THE STARTER
GENERATOR). GREASE WASHOUT CAN RESULT IN A
FUEL CONTROL FAILURE.

Leakage noted?

Yes

Replace the fuel control, TM 55-2840-256-23,
tasks 7-2-11, 7-2-12.

Fuel leaking from the fuel control weep holes
BUT NOT from the fuel control/fuel pump
overboard drain can be an indication that the
drain is blocked and that allowable fuel pump
seal leakage is backing up into the fuel control
drive housing.

Inspect to make certain that the overboard drain
is open and unobstructed, and that leakage
from the fuel pump to fuel control drive shaft
seal is within limits (10 drops per minute).

No

Drain blocked?

Yes

Remove, clear, and reinstall drain lines
and fittings.

No

Pump seal leakage excessive?

Yes

Inspect and/or replace fuel pump,
TM 55-2840-256-23,
tasks 7-3-1, 7-3-2,
7-3-3.

No

Return to service
OFF-6 AFTERFIRE. TGT INCREASE AFTER ENGINE SHUTDOWN INDICATING RESIDUAL FIRE IN THE COMBUSTOR.


Inspect fuel control throttle rigging, TM 55-2840-256-23, task 7-2-1. Repair/adjust as necessary, TM 55-1520-248-23, tasks 4-6-1 through 4-6-8.

- Repair required?
  - Yes
  - Cut off OK?
    - Yes
      - Service drain valve, TM 55-2840-256-24, task 4-5-3.
    - No
  - No

Inspect fuel control cut off valve, TM 55-2840-256-23, task 7-2-6.

- Repair/adjustment necessary?
  - Yes
  - Cut off OK?
    - Yes
      - Perform troubleshooting sequence of Procedure OFF-7 (Smoking after shutdown).
    - No
  - No

Replace fuel control, TM 55-2840-256-23, tasks 7-2-11, 7-2-12.

- Cut off OK?
  - Yes
    - Return to service
  - No
    - Remove and inspect combustor drain valve, TM 55-2840-256-23, task 4-5-1.

- Drain valve stuck closed?
  - Yes
  - No
OFF-7 SMOKING DURING OR IMMEDIATELY FOLLOWING ENGINE SHUT DOWN. (LIGHT WISPS OF SMOKE CAN BE NORMAL AND ARE NOT CAUSE FOR MAINTENANCE ACTION UNLESS OIL CONSUMPTION LIMITS ARE EXCEEDED.)


- **Inspect exhaust collector for wetness, oil puddling, and drain blockage.**
  - **Oil evident?**
    - **Yes**
      - **Return to service**
    - **No**
      - **OFF-7A**
        - **Remove, service (replace if necessary) combustor drain valve, TM 55-2840-256-23, tasks 4-5-1, 4-5-2, 4-5-3.**
  - **Exh. coll. drain blocked?**
    - **Yes**
      - **Clear, smoking eliminated?**
        - **Yes**
          - **OFF-7AA**
            - **Replace breather gearshaft lip seal, TM 55-2840-256-23, task 6-1-4. This requires engine removal/reinstall. TM 55-1520-248-23, tasks 4-1-1, 4-1-2, and compressor and turbine modules removal/reinstallation, TM 55-2480-256-23, tasks 3-1-1, 3-1-2, 5-1-2, 5-1-3.**
        - **No**
          - **Smoking corrected?**
            - **Yes**
              - **Replace turbine module, TM 55-2840-256-23, tasks 5-1-2, 5-1-3. This requires engine removal/reinstall. TM 55-1520-248-23, task 4-1-1, 4-1-2, and combustion module removal/reinstallation, tasks 4-1-4, 4-1-5. Start engine to ground idle. Measure and adjust main oil pressure, tasks 1-8-12 and 6-2-9. Verify smoking eliminated on shutdown.**
            - **No**
              - **Comp. seal vent?**
                - **Yes**
                  - **Check and adjust diffuser vent orifice as required, TM 55-2840-256-23, task 3-5-2.**
                - **No**
                  - **Return to service**
        - **No**
          - **Visually determine source of escaping oil: No. 5 labyrinth seal? Compressor rear seal vent? AGB breather vent?**
  - **No**
    - **Smoking corrected?**
      - **Yes**
        - **Scavenge flow checks OK?**
          - **Yes**
            - **OFF-7C**
              - **Page 62 of 63**
          - **No**
            - **Page 62 of 63**
      - **No**
        - **Service power turbine support oil supply and scavenge elements, TM 55-2840-256-23: (1) Remove, service and reinstall power turbine pressure oil fitting, screen, and nozzle, tasks 1-8-3, 1-8-4, 1-8-5. (2) Service power turbine scavenge oil strut, task 1-8-6. (3) Remove and service scavenge oil sum, tasks 1-8-7, 1-8-8, 1-8-10. (4) Measure oil flow from power turbine scavenge oil strut, task 1-8-9. (5) Measure engine oil system scavenge oil flow, task 1-8-11.**

Replace external check valve in turbine pressure oil supply line (right side of engine just below horizontal heat shield, direction of flow arrow pointed aft.).

Remove oil filter housing and check valve assembly, TM 55-2480-256-23, tasks 6-2-3. Inspect O ring lands on oil transfer tubes and in tube bores in oil filter housing and accessory gearbox housing for wear. Replace check valve.

Transfer tube or check valve wear in AGB housing? Yes →

Replace oil transfer tubes if wear is seen on O-ring lands.

Reinstall oil filter housing and check valve assembly, TM 55-2840-256-23, task 6-2-4.

During ground check run, measure and adjust main oil pressure, TM 55-2840-256-23, tasks 1-8-12 and 6-2-9.

Smoking eliminated? Yes →

Inspect scavenge return components in aircraft system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, etc), for restrictions, dents, or kinks, and correct as necessary. Also check oil tank vent line. Replace scavenge oil filter element, TM 55-15210-248-23, task 4-4-17. Run engine and shut down to verify smoking eliminated.

No →

Oil running from comb. drain valve? Yes →

No →

Return to service

OFF-7C

OFF-7B
Appendix B

Model 250-C30R/3 Basic Engine Fault Isolation and Correction
Visio Charts

51 Procedures (146 pages)
St-1 intentionally omitted.
St-2. Compressor Surges During Starts

There are several causes of compressor surge during engine starting, among which are:

- ECU fault
- HMU fault
- Compressor inlet thermal distortion (exhaust gas ingestion)
- Compressor inlet blockage or pressure distortion
- Compressor inducer bleed duct blockage or hose disconnection
- Compressor contamination, damage or erosion
- Turbine blockage or damage

If surges during starting are encountered, proceed as follows:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether the surge problem still exists.

Were ECU or HMU replaced?

Visually inspect compressor air inlet for blockage, by viewing through inlet plenum observation window.

Compressor inlet blockage noted?

Verify surging was not result of exhaust gas ingestion, by heading aircraft into wind during starting (if it had been positioned with tail into wind when surging occurred). If so, attempt a start.

Had aircraft been positioned tail to wind?

Did repositioning eliminate surging?

Return to service

Return to service

- Remove engine IAW similar to TM55-1520-248-23, Task 4-1-1.
- Remove and replace compressor module IAW TM1-2840-263-23, 72-50-00, para. 1-A and 1-B. (This also requires removal and reinstallation of turbine module IAW TM1-2840-263-23, 72-50-00, para. 1-A and 1-B.)
- Identify replaced compressor module as having been subjected to inlet blockage and send to overhaul.
- Determine source of object obstructing compressor inlet and correct condition, which may involve cleaning, inspecting, and repairing air induction cowl IAW similar to TM55-1520-248-23, Task 4-2-2.
- Reinstall engine IAW similar to TM55-1520-248-23, Task 4-1-2.
- As a part of the check runs accompanying engine installation, Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TM1-2840-263-23, 72-00-00, para. 1.A Operating Instructions, para. 1.B. Diffuser Vent Orifice Selection.

1.0 Dec 1997

2 Sep 1997
Rev. A 10 Dec 1997

EDR 18882
Page B-2
St-2 A

- Inspect the compressor inducer bleed hose, to verify that it is connected to the compressor shroud bleed manifold on the bottom end and, on the top end, to the attachment on the engine cowl carryoff duct.
- Check hose for kinks and cowl carryoff duct for obstructions.
- Take corrective action if any of these conditions are noted, then attempt a start and determine whether the surge problem still exists.

Diffuser bleed hose restricted or disconnected?

Yes → Was start OK after correcting?

Yes → Return to service

No → Compressor damage or erosion noted?

Yes → Compressor dirty and in need of cleaning?

Yes → Reinstall the air induction cowl IAW similar to TM55-1520-248-23, Task 4.2.1.
- Wash the compressor IAW TM1-2840-263-23, 72-30-00, para. 4.
- Attempt a start after the drying run (if successful) and determine whether the surge problem still exists.

No → Return to service

Was start OK after correcting?

Yes → Return to service

No → Compressor dirty and in need of cleaning?

Yes → Reinstall engine IAW similar to TM55-1520-248-23, Task 4.1-1.
- Remove and replace compressor module IAW TM1-2840-263-23, 72-50-00, para. 1-A and 1-B (this also requires removal and reinstallation of turbine module IAW TM1-2840-263-23, 72-50-00, para. 1-A and 1-B).
- Reinstall engine IAW similar to TM55-1520-248-23, Task 4.1-2
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TM1-2840-263-23, 72-00-00, para. 1-A Operating Instructions, para. 1-B. Diffuser Vent Orifice Selection

No → Return to service
St-2. Compressor Surges During Starts

- Remove combustion module IAW TM1-2840-263-23, 72-40-00, para. 1.A.
- Inspect combustion outer case and liner IAW TM1-2840-263-23, 72-40-00, para. 1.C and 2.B respectively.
- Inspect first stage nozzle shield, nozzle, and turbine wheel IAW TM1-2840-263-23, 72-50-00, para. 5.C and 5.D.

Is turbine acceptable or repairable without teardown?

- Yes
  - Remove engine IAW similar to TM55-1520-248-23, Task 4-1-1.
  - Remove and replace turbine module IAW TM1-2840-263-23, 72-50-00, para. 1.A and 1.B.
  - If required, make repairs to outer combustion case IAW TM1-2840-263-23, 72-40-00, para. 2.A and 2.B (or replace).
  - If required, make repairs to combustion liner IAW TM1-2840-263-23, 72-40-00, para. 1.A through 1.C (or replace).
  - Install combustion module IAW TM1-2840-263-23, 72-40-00, para. 1.B.
  - Reinstall engine IAW similar to TM55-1520-248-23, Task 4-1-2.
  - Attempt a start and determine whether the surge problem still exists.

- No

Was HMU changed earlier in this procedure?

- Yes
  - Was ECU changed earlier in this procedure?
    - Yes
      - Remove and replace ECU IAW similar to TM55-1520-248-23, Tasks 9-7-2 and 9-7-3.
      - Attempt a start and determine whether the surge problem still exists.
    - No
      - Return to service

- No
  - Return to service

Remove and replace HMU IAW TM1-2840-263-23, 73-21-01, para. 1.A and 1.B.

Was start OK?

- Yes
  - Return to service

- No

Remove and replace engine IAW similar to TM55-1520-248-23, Tasks 4-1-1 and 4-1-2.

Was start OK?

- Yes
  - Return to service

- No

2 Sep 1997
Rev. A 10 Dec 1997
Rev. 11 Jul 99
This event, which usually occurs at cold ambient temperatures above 5000 ft. altitude, is normally the result of fuel nozzle carbon deposits, but could also result, among other things, from the following factors:

- HMU
- ECU
- Fuel nozzle immersion depth
- Fuel characteristics
- Combustion module anomaly

If flameouts after lightoff at cold/high altitude conditions are encountered, proceed as follows:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether the flameout problem still exists.

Are ECU or HMU replaced?

No

Yes

Was subsequent start OK?

No

Yes

Return to service

Were ECU or HMU replaced?

No

Was start OK?

No

Yes

Return to service

Yes

Install fuel nozzle IAW TM1-2840-263-23, 73-10-03, para. 1.B. Select spacers to provide a D dimension as close to the allowable maximum as possible. Attempt a start and determine whether the flameout problem still exists.

Install fuel nozzle IAW TM1-2840-263-23, 73-10-03, para. 1.B.


Fuel nozzle flow pattern OK?

No

Yes

Was start OK?

No

Yes

Return to service

Return to service

Verify type of fuel currently in aircraft tank. For consistent starting at ambient temperatures below +40°F (+4°C), JP-4 (Mili-T-5624) or Jet B (ASTM D-1655) are the recommended fuels.

Are current ambient temperature below 40°F?

Yes

St-3 A (Pg 2)

No

St-3 B (Pg 2)

2 Sep 1997

Rev. A 11 Dec 1997
St-3. Flames Out After Lightoff During Start Attempts At High Altitude/Cold Ambient Conditions

- Defuel aircraft IAW similar to TM55-1520-248-23, Task 1-4-3 or 1-4-4
- Refuel with JP-4 (MIL-T-5624) or Jet B (ASTM D-1655), IAW TM55-1520-248-23, similar to Task 1-4-1 or 1-4-2
- Drain engine fuel filter IAW similar to TM55-2840-256-23, Task 7-1-2
- Purge fuel system IAW similar to TM55-2840-256-23, Task 7-1-2

Attempt a start and determine whether the flameout problem still exists.

Was start OK?

- No
  - Return to service

- Yes
  - Return to service

Was HMU changed earlier in this procedure?

- No
  - Remove and Replace ECU IAW similar to TM55-1520-248-23, Tasks 9-7-2 and 9-7-3
  - Attempt a start and determine whether the flameout problem still exists

- Yes
  - Was ECU changed earlier in this procedure?
    - No
      - Was start OK?
        - Yes
          - Return to service
        - No
          - Return to service
    - Yes
      - Remove and Replace ECU IAW similar to TM55-1520-248-23, Tasks 4-1-1 and 4-1-2

- If required, make repairs to outer combustion case IAW TM1-2840-263-23, 72-40-00, para. 2.A and 2.B (or replace).
- If required, make repairs to combustion liner IAW TM1-2840-263-23, 72-40-00, para. 1.A through 1.C (or replace)
- Install combustion module IAW TM1-2840-263-23, 72-40-00, para. 1.B.

Attempt a start and determine whether the flameout problem still exists.

Was start OK?

- No
  - Remove and Replace HMU IAW TM1-2840-263-23, 73-21-02, para. 1.A and 1.B
  - Attempt a start and determine whether the flameout problem still exists

- Yes
  - Return to service

Remove and Replace ECU IAW similar to TM55-1520-248-23, Tasks 9-7-2 and 9-7-3

Was start OK?

- No
  - Return to service

- Yes
  - Return to service

2 Sep 1997
Rev. A 11 Dec 1997
Rich/delayed lightoffs are characterized by a somewhat sharp 'WOOF' sound and are frequently accompanied by brief torching from the engine exhaust. They are usually the result of excess raw fuel or oil in the combustion section, or delayed ignition. Most common sources of the problem are:

- ECU
- HMU
- Faulty ignition exciter, lead, or spark igniter
- Faulty burner drain valve
- Faulty check valve in turbine oil supply line
- Faulty main check valve in engine lube system
- Fuel nozzle spray pattern non-uniformity
- Fuel nozzle flow divider

If Rich/Delayed lightoffs are experienced, proceed as follows:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, perform a start and determine whether the lightoff problem still exists.

Remove, service, and reinstall burner drain valve, IAW TMI-2840-263-23, 72-40-00, para 3.A. through 3.C
Observe for oil drainage from burner drain port while drain valve removed

Oil drainage observed? Yes
St-4 C [Pg 2]

Start engine and run at ground idle until oil temperature stabilizes. Shut down and remove burner drain valve (TMI-2840-263-23, 72-40-00, para 3.A.) just as soon as engine rotors coast down. Place a container under the burner drain boss to collect oil leaking therefrom. Measure and record the amount of leakage each hour for 2 hours.

Does leakage continue after 1st hour? Yes
St-4 A [Pg 2]

Was start OK? Yes
Return to service
No
St-4 C [Pg 2]

Replace external turbine oil check valve
Reinstall burner drain valve, IAW TMI-2840-263-23, 72-40-00 para 3.B.
Start engine and run at ground idle until oil temperature stabilizes. Shut down and observe for oil drainage through burner drain valve

Oil drainage observed? Yes
St-4 B [Pg 2]

Perform a start and determine whether the lightoff problem still exists.

Was start OK? Yes
Return to service
No
St-4. Rich/Delayed Light-off

St-4 A

Reinstall burner drain valve, IAW TMI-2840-263-23, 72-40-00, para 3.B.

St-4 B

Remove oil filter housing from accessory gearbox IAW TMI-2840-263-23, 72-60-00, para 1.D.

Replace main oil system check valve. Reassemble housing, tubes, and check valve to AGB IAW (similar to TM55-2840-256-23, Task 6-2-4). Perform a start and determine whether the lightoff problem still exists.

St-4 C

Yes

Exciter sparking rate OK?

No

St-4 BB (Pg 3)

Replace Ignition exciter
Remove and install IAW TMI-2840-263-23, 74-10-01, para 1.A and 1.B.

Yes

Exciter sparking rate OK?

No

St-4 BB (Pg 3)


Igniter lead OK?

Yes

Replace igniter lead

No

Install igniter lead IAW TMI-2840-263-23, 74-20-02, para 1.B.

IAW TM55-2840-256-23, Task 8-2-1. Sparks should be evenly spaced at a rate of about TBD snaps per second.

Yes

Exciter sparking rate OK?

No

St-4 BB (Pg 3)

Remove and inspect spark igniter, IAW TMI-2840-263-23, 74-20-01, para 1.A and 2.A.

St-4 AA (Pg 3)

Was start OK?

Yes

Return to service

No
St-4. Rich/Delayed Light-off

St-4

AA

Spark igniter OK? Yes

Replace spark igniter

No

Install spark igniter IAW TMI-2840-263-23, 74-20-01, para 1. B. Perform a start and determine whether the lightoff problem still exists.

Was start OK? Yes

Return to service

No


Was start OK? Yes

Install fuel nozzle IAW TMI-2840-263-23, 73-10-03, para 1B. Select spacers to provide a D dimension as close to the allowable maximum as possible. Perform a start and determine whether the lightoff problem still exists.

No

Was start OK? Yes

Return to service

No

Replace fuel nozzle IAW TM55-2840-256-23, Task 7-4-5. Select spacers to provide a D dimension as close to the allowable maximum as possible. Perform a start and determine whether the lightoff problem still exists.

Was start OK? Yes

Return to service

No

Was HMU changed earlier in this procedure? Yes

No

St-4

AAA

(Pg 4)

St-4

BBB

(Pg 4)

22 Sep 1997
Rev. A 22 Dec 1997
Rev. 11 Jul 99
St-4. Rich/Delayed Light-off

St-4 AAA

Remove and Replace HMU
IAW TMI-2640-263-23, 73-21-01, para 1.A. and 1.B.
Perform a start and determine whether the lightoff problem still exists.

Was start OK? No

Yes

Return to service

St-4 BBB

Was ECU changed earlier in this procedure?

Yes

Remove and Replace engine IAW (Similar to TM55-1520-248-23, Tasks 4-1-1 and 4-1-2)

No

Remove and Replace ECU IAW (Similar to TM55-1520-248-23, Tasks 9-7-2 and 9-7-3).
Perform a start and determine whether the lightoff problem still exists.

Was start OK? No

Remove and Replace engine IAW (Similar to TM55-1520-248-23, Tasks 4-1-1 and 4-1-2).

Yes

Return to service

22 Sep 1997
Rev. A 22 Dec 1997
During the normal start sequence, fuel flow is automatically initiated at 12% Ng (10% Ng at engine inlet temperatures below 20°F [-6°C]). Failure to light off at (or above) these speeds may be caused by the following:

- ECU fault
- HMU fault
- Fuel supply blocked or restricted, or no boost
- Throttle linkage misrigged
- Faulty ignition exciter, lead, or spark igniter
- Fuel nozzle spray pattern non-uniform
- Fuel nozzle immersion depth improperly set
- Combustion system anomaly
- Water in fuel

If the engine motors to the required speed but fails to light off, proceed as follows:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether the lightoff problem still exists.

Were ECU or HMU replaced?

Was subsequent start OK?

Determine by observation whether a cloud of atomized fuel exits from the engine exhaust during start attempts and is accompanied by fuel wetting of the inner walls of the exhaust collector and exhaust duct.

Does fuel cloud exit from exhaust?

Exciter sparking rate OK?

Remove and test igniter lead, IAW TMI-2840-263-23, 74-10-01, para 1.A., 2.A. and 2.B.

Igniter lead OK?

Replace igniter lead

Install igniter lead IAW TMI-2840-263-23, 74-20-02, para 1.B.

Exciter sparking rate OK?

Replace ignition exciter

Return to service
**St-5 Motors To Required Speed But Does Not Light Off**

**St-5 A**
  - **Spark igniter OK?**
    - Yes
      - **Replace spark igniter**
    - No
      - **Install spark igniter IAW TMI-2840-263-23, 74-20-01, para 1.B.**
      - Attempt a start and determine whether the lightoff problem still exists.
      - **Was start OK?**
        - Yes
          - **Return to service**
        - No
    - **Was start OK?**
      - Yes
        - **Return to service**
      - No

**St-5 B**
  - **Fuel nozzle flow pattern OK?**
    - Yes
      - **Install fuel nozzle IAW TMI-2840-263-23, 73-10-03, para 1.B.**
      - Select spacers to provide a D dimension as close to the allowable maximum as possible.
      - Attempt a start and determine whether the lightoff problem still exists.
    - No
      - **Was start OK?**
        - Yes
          - **Return to service**
        - No
          - **Replace fuel nozzle**

18 Sep 1997
Rev. A 29 Dec 1997

EDR 18882
St-5 Motors To Required Speed But Does Not Light Off

St-5 C

Inspect fuel control rigging IAW (Similar to TM55-2840-256-23, Task 7-2-1).

Rigging OK? (Yes/No)

Yes -> Constant flow of fuel from fuel nozzle hose?
No -> Attempt a start and determine whether the lightoff problem still exists.

Constant flow of fuel from fuel nozzle hose? (Yes/No)

Yes -> Attempt a start and determine whether the lightoff problem still exists.
No -> Refuel as needed.

Was start OK? (Yes/No)

Yes -> Return to service (St-5 CCC pg 4)
No -> Refuel as needed.

Was the start OK? (Yes/No)

Yes -> Return to service
No -> St-5 AAA (pg 4)

Did boost pump provide flow of fuel? (Yes/No)

Yes -> St-5 BBB (pg 9)
No -> St-5 AAA (pg 4)

18 Sep 1997
Rev. A 29 Dec 1997
St-5 Motors To Required Speed
But Does Not Light Off

Perfom such troubleshooting of the aircraft fuel supply system as required to ensure fuel supply to the HMU inlet. The following items should be investigated until the specific problem area is located and corrected:

- Electrical circuits to boost pump IAW (Similar to TM 55-1520-248-23, Appendix K or N).
- Rigging of aircraft fuel shutoff valve IAW (Similar to TM 55-1520-248-23, Tasks 10-1-3.1). Re-rig as required.
- Fuel boost pump (remove, repair/replace, and reinstall IAW (Similar to TM 55-1520-248-23, Tasks 10-1-16 through 10-1-18). Verify adequate fuel supply to the engine by purging fuel system IAW (Similar to TM 55-2840-256-23, Task 7-1-1).

**St-5 AAA**

Disassemble and inspect as follows:
- Inspect combustion outer case and liner IAW TMI-2840-263-23, 72-40-00, para 1.C. and 2.B., respectively.
- Inspect first stage nozzle shield, nozzle, and turbine wheel IAW TMI-2840-263-23, 72-50-00, para 5.C. and 5.D. Reassemble as follows:
  - Install first stage nozzle shield (replace existing part if condition requires).
  - If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B. (or replace).
  - If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. (or replace).

Attempt a start and determine whether the lightoff problem still exists.

**St-5 CCC**

**Was the start OK?**

- **No**
  - Return to service

- **Yes**
  - **St-5 BBB (Pg 5)**

**St-5 BBB (Pg 5)**

**Was the start OK?**

- **No**
  - Return to service

- **Yes**
  - **St-5 AAA**

**Constant flow of fuel from fuel nozzle hose?**

- **No**
  - Attempt a start and determine whether the lightoff problem still exists.

- **Yes**

16 Sep 1997
Rev. A 29 Dec 1997
St-5 Motors To Required Speed
But Does Not Light Off

Was HMU changed earlier in this procedure? Yes No
Remove and Replace HMU IAW TMI-2840-263-23,
73-21-01, para 1.A and 1.B.
Perform a start and determine whether the lightoff problem still exists.

Was ECU changed earlier in this procedure? Yes No
Remove and Replace engine IAW (Similar to TM55-
1520-248-23, Tasks 4-1-1 and 4-1-2).

Was start OK? No Yes
Remove and Replace ECU IAW TMI-2840-263-23,
Perform a start and determine whether the lightoff problem still exists.

Was start OK? No Yes
Return to service

Remove and Replace engine IAW (Similar to TM55-
1520-248-23, Tasks 4-1-1 and 4-1-2).

Return to service
St-5 Motors To Required Speed
But Does Not Light Off

Disconnect the engine accessory harness connector at the ignition exciter (Connector P12). Measure voltage between harness connector sockets 1 (hot) and 2 (ground), while motoring engine with starter (throttle in cutoff position), using multimeter. Voltage should be steady and between TBD and TBD VDC.

Measured voltage within limits?

Yes → St-5 AAAA (Pg 1)

No → Troubleshoot engine and/or aircraft electrical circuits associated with power to the exciter IAW (Similar to TM 55-2840-256-23, Task 8-1-1) and (Similar to TM 55-1520-248-23, Appendix K or N)

If required, remove and replace the engine accessory harness IAW TMI-2840-263-23, 73-21-00, para 3.A. and 3. B.

Return to service

Yes → Was the start OK?

No → St-5 B (Pg 2)

Was the start OK?

Yes → Attempt a start and determine whether the lightoff problem still exists.

No → Exciter sparking rate OK?

Yes → St-5 AAAA (Pg 1)

No → St-5 E (Pg 6)

Was the start OK?

No → St-5 CCC (Pg 4)

Yes → Return to service

Draw fuel sample from bottom of aircraft fuel tank (sump drain) and check for water.

If high water content is determined, defuel aircraft IAW (Similar to TM 55-1520-248-23, Task 1-4-3), and refuel per tasks 1-4-1 or 1-4-2.

Flush aircraft and engine fuel systems as follows:

- Disconnect aircraft fuel supply hose at HMU fuel inlet port.
- Direct hose into a bucket or similar container.
- Be sure aircraft fuel shutoff valve fully open (lever fully forward).
- Turn Fuel Boost switch on forward overhead console ON. This engages fuel boost pump.
- Verify that fuel is flowing into bucket.
- Flow at least 2 gallons of fuel and then turn Fuel Boost switch OFF and verify fuel flow ceases.
- Remove and replace fuel filter element IAW TMI-2840-263-23, 73-21-00, para 3.A and 3.B.
- Flush fuel system IAW (Similar to TM 55-2840-256-23, Task 7-1-4).

Attempt a start to determine whether the lightoff problem still exists.
During the normal start sequence, fuel flow is automatically initiated at 12% Ng (10% Ng at engine inlet temperatures below 20°F [-6°C]). Lightoffs occurring at lower speeds indicate a problem which may result from any of the following conditions:

- ECU fault
- HMU fault
- Throttle linkage misrigged
- Faulty burner drain valve

If lightoffs occur at speeds below 12% Ng (10% Ng at engine inlet temperatures below 20°F), proceed as follows to correct the problem:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether premature lightoff problem still exists.

Were ECU or HMU replaced?

- No
  - Was subsequent start OK?
    - Yes
      - Return to service
    - No
      - Start satisfactory?
        - Yes
          - Attempt a start and determine whether premature lightoff problem still exists.
        - No
          - Attempt a start and determine whether premature lightoff problem still exists.

- Yes
  - Attempt a start and determine whether premature lightoff problem still exists.

Flow of fuel stopped in cutoff position?

- No
  - Inspect fuel control rigging IAW (Similar to TM 55-2840-256-23, Task 7-2-1)
  - If required, re-rig throttle linkage IAW (Similar to TM 55-1520-248-23, Task 4-6-1)
  - Purge fuel system IAW (Similar to TM 55-2840-256-23, Task 7-1-1). At completion of purging, visually confirm that fuel flow ceased when twist grip was returned to cutoff position.

- Yes
  - Return to service

St-6 A (Pg 2)

Start satisfactory?

- No
  - Return to service

- Yes
  - St-6 B (Pg 2)

Return to service

22 Sep 1997
Rev. A 29 Dec 1997

EDR 18862 Page B-17
St-6 Lights Off Prior To Scheduled Fuel Introduction Speed

St-6

- Disconnect engine harness connector P4 at HMU.
- Again purge fuel system IAW TM55-2840-256-23, Task 7-1-1).
  At completion of purging, visually confirm that fuel flow ceased when twist grip was returned to cutoff position.
- Reconnect P4 connector at HMU.

St-6 B

Remove and Replace ECU
IAW (Similar to TM55-1520-248-23, Tasks 9-7-2 and 9-7-3)
Perform a start to demonstrate premature lightoff problem corrected

Return to service

Flow of fuel stopped in cutoff position?

Yes

No

Remove and Replace HMU
IAW TMI-2840-263-23, 73-21-01, para 1.A and 1.B.
Attempt a start and determine whether premature lightoff problem still exists.

Start satisfactory?

No

Yes

Return to service

22 Sep 1997
Rev. A Dec 29 1997
St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

Starts where the engine lights off satisfactorily but accelerates abnormally slowly or stagnates prior to reaching ground idle speed (64% Ng) may be the result of one or more of the following conditions:

- ECU
- HMU
- Low battery
- Degraded starter
- Inadequate engine fuel supply
- Faulty fuel nozzle
- Anti-icing system ON or leaking
- Engine bleed air extraction for aircraft cabin heating ON or leaking
- Damaged or eroded compressor

If slow or stagnated starts are experienced, proceed as follows to correct condition:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether slow/stagnated starts still occur.

- Were ECU or HMU replaced?
  - Yes
  - Was subsequent start OK?
    - Yes
    - Return to service
    - No
    - No
    - No
    - Power up aircraft electrical system IAW (Similar to TM 55-1520-248-23, Task 9-3-10, using APU power if available):
      - With IGN circuit breaker pulled in forward overhead console panel and twist grip in cutoff position, engage starter and determine maximum available motor speed.

Minimum acceptable speeds are:
- APU TBD% Ng
- Battery TBD% Ng

- Was APU used?
  - Yes
  - Was motoring speed satisfactory?
    - Yes
    - Yes
    - No
    - No
    - Remove and replace starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15).
    - Recheck motoring speed to verify at least TBD% Ng.
  - No

- Was motoring speed satisfactory?
  - Yes
  - No
  - Remove and replace battery IAW (Similar to TM 55-1520-248-23, Task 9-3-4).
  - Recheck motoring speed to verify at least TBD% Ng.

- Was motoring speed satisfactory?
  - Yes
  - No
  - St-7 A (Pg 2)
  - St-7 B (Pg 2)

23 Sep 1997
Rev. A 9 Jan 1998
St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

St-7 A

- Remove and replace starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-16).
- Recheck motorizing speed to verify at least TBD% Ng.

St-7 B

Attempt a start and determine whether slow/stagnated starts still occur.

Start satisfactory?

- Yes
  - Return to service
- No
  - Constant flow of fuel from fuel nozzle hose?
    - Yes
      - Attempt a start and determine whether slow/stagnated starts still occur.
      - Start satisfactory?
        - Yes
          - Return to service
        - No
          - Verify adequate supply of fuel in aircraft. Refuel as needed.
          - Disconnect aircraft fuel supply hose at HMU fuel inlet port.
          - Direct hose into a bucket or similar container.
          - Be sure aircraft fuel shutoff valve fully open (lever fully forward).
          - To prevent starter engagement, pull START circuit breaker on forward overhead console [TBD].
          - Leave Fuel Boost switch OFF on forward overhead console.
          - Engage fuel boost pump by turning on START switch on pilot’s collective stick (if functioning, pump will be audible).
          - Verify that fuel is flowing into bucket
          - Turn START switch OFF and verify fuel flow ceases.

- No
  - St-7 AA (Pg 3)

- Verify adequate fuel supply to the engine by purging fuel system IAW (Similar to TM55-2840-256-23, Task 7-1-1).
- During purging, observe for constant flow of fuel from end of fuel nozzle hose.

St-7 CC (Pg 4)

- Did boost pump provide flow of fuel?
  - No
    - St-7 BB (Pg 3)
  - Yes

23 Sep 1997
Rev. A 9 Jan 1995
St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

St-7 AA


Fuel nozzle flow pattern OK?

Yes

Install fuel nozzle IAW TMI-2840-263-23, 73-10-03, para 1.B. Select spacers to provide a D dimension as close to the allowable maximum as possible.

No

Replace fuel nozzle. Install replacement nozzle IAW TMI-2840-263-23, 73-10-03, para 1.B. Select spacers to provide a D dimension as close to the allowable maximum as possible.

Replace fuel nozzle

Attempt a start and determine whether slow/stagnated starts still occur.

Start satisfactory?

Yes

Return to service

No

Start satisfactory?

Yes

Return to service

No

St-7 AAA (Pg 5)

St-7 BB

Was HMU changed earlier in this procedure?

Yes

Remove and Replace HMU IAW TMI-2840-73-21-01, para 1.A and 1.B.

No

Attempt a start and determine whether slow/stagnated starts still occur.

Start satisfactory?

Yes

Return to service

No

St-7 BBB (Pg 4)
**St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate**

1. **Perform such troubleshooting of the aircraft fuel supply system as required to ensure fuel supply to the HMU inlet.** The following items should be investigated until the specific problem area is located and corrected:
   - Electrical circuits to boost pump IAW (Similar to TM 55-1520-248-23, Appendix K or N).
   - Rigging of aircraft fuel shutoff valve IAW (Similar to TM 55-1520-248-23, Tasks 10-1-3-1. Rig as required).
   - Fuel boost pump (remove, repair/replace, and reinstall IAW (Similar to TM 55-1520-248-23, Tasks 10-1-16 through 10-1-18).
   - Verify adequate fuel supply to the engine by purging fuel system IAW (Similar to TM55-2840-256-23, Task 7-1-1-1).

2. **Attempt a start and determine whether slow/stagnated starts still occur.**
   - **Start satisfactory?**
     - **Yes**
       - **Return to service**
     - **No**
       - **St-7 AA (Pg 3)**

3. **Remove and Replace ECU IAW (Similar to TM55-1520-248-23, Tasks 9-7-2 and 9-7-3).**
   - **Attempt a start and determine whether slow/stagnated starts still occur.**
     - **Start satisfactory?**
       - **Yes**
         - **Return to service**
       - **No**
         - **St-7 AA (Pg 3)**

---

**23 Sep 1997**

**Rev. A 9 Jan 1998**
St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

Excessive air bleed or air leakage from the compressor, or between the compressor and turbine, may be the cause of the problem. Different means will be used to search for the leakage, depending on whether the engine can reach ground idle conditions without exceeding limits.

Can engine reach idle without exceeding limits?

Yes → Start engine and stabilize at ground idle.

No →

Visually inspect the following areas for evidence of air leakage, cracks, or looseness, and, if observed, make repairs IAW the referenced tasks in TMI-2840-263-23, 72-30-00:

- COMPRESSOR SCROLL -- include flanges for aircraft bleed air off-take and unused bleed air off-take. Leakage from cracks in scroll, or from scroll-to-shroud or scroll-to-rear diffuser flanges are cause for compressor module replacement, which requires engine removal and reinstallation. Repair allowable leaks - Para 3.D., and (Similar to TM 55-1520-248-23, Task 4-1-5). Remove engine/replace compressor module/reinstall engine.
  - Tasks 3-1-1, 3-2-2, 4-1-2, 5-1-3, and Para 1.A. and 1.B. and (Similar to TM 55-1520-248-23, Tasks 4-1-1 & 4-1-2.


- AIRCRAFT BLEED AIR TUBE, from compressor scroll to heater mixing valve -- Visually inspect as well as check for looseness. Remove/repair/reinstall IAW (Similar to TM 55-1520-248-23, Tasks 4-1-5, 13-1-13, & 13-1-14)

Inspect for air leakage in the following areas and, if located, make repairs IAW the referenced tasks in TMI-2840-263-23, 72-30-00:

- COMPRESSOR SCROLL -- include flanges for aircraft bleed air off-take and unused bleed air off-take. Leakage from cracks in scroll, or from scroll-to-shroud or scroll-to-rear diffuser flanges are cause for compressor module replacement, which requires engine removal and reinstallation. Inspect - Para 3.D. Repair allowable leaks - and (Similar to TM 55-1520-248-23, Task 4-1-5.) Remove engine/replace compressor module/reinstall engine - Para 1.A and 1.B. (Similar to TM 55-1520-248-23, Tasks 4-1-1 & 4-1-2)

- COMBUSTION MODULE -- Inspect - Task 4-1-1. Remove/repair/reinstall - Tasks 4-1-2, 4-1-3, 4-2-1, 4-2-2, 4-4-1, 4-4-2, 4-4-3, 4-4-5, & 4-4-6.


- AIRCRAFT BLEED AIR TUBE, from compressor scroll to heater mixing valve -- Inspect - use leak detection procedures of IAW TMI-2840-263-23, 75-10-01, para 3.A and 3.B. Remove/repair/reinstall IAW (Similar to TM 55-1520-248-23, Tasks 4-1-5, 13-1-13, & 13-1-14)
St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

While operating at ground idle, inspect anti-icing system solenoid valve, tube from solenoid valve to anti-icing valve, and anti-icing valve body and mounting flange for leakage, IAW TMI-2840-263-23, 75-10-01, para 3.A. and 3.B. Verify function of solenoid valve by cycling anti-icing system ON - OFF and observing change in flow rate from solenoid valve vent (decreases when OFF is selected).

Correct leaks or malfunctions IAW TMI-2840-263-23, 75-10-01, para 2.A., B., 3.A and 3.B., as applicable.

Reinstall tube between anti-icing valve and front support.

Isolate aircraft heater by disconnecting aircraft bleed air tube at heater mixing valve inlet and plugging end of tube.

Attempt a start and determine whether slow/stagnated starts still occur.

Start satisfactory?

Yes

Start satisfactory?

No

Return to service

Isolate the anti-icing system by removing the tube between the anti-icing valve and the front support, and capping the exposed fittings on both the anti-icing valve and the front support

Attempt a start and determine whether slow/stagnated starts still occur.

Find and correct any leaks or malfunctions?

Yes

Replace anti-icing valve IAW TMI-2840-263-23, 75-10-01, para 2.A. and 2.B.

Reinstall tube between anti-icing valve and front support.

Test anti-icing system IAW TMI-2840-1, 75-10-01, para 3.B.

Start satisfactory?

Yes

Return to service

No

Replace upper and lower bleed air tubes and engine deck union.

Using new flange gasket, reconnect scroll end of tube IAW (Similar to TM 55-2840-255-23, Task 4-1-5). Install plug in heater mixing valve end of tube.

Attempt a start and determine whether slow/stagnated starts still occur.

Start satisfactory?

Yes

No

St-7 6A (Pg 7)

St-7 6B (Pg 7)

St-7 5C (Pg 8)

Remove plug from lower end of bleed air tube and reconnect to heater mixing valve.

23 Sep 1997
Rev. A 9 Jan 1998
St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

**St-7 5A**

Repair or replace aircraft heater mixing valve IAW (Similar to TM 55-1520-248-23, Tasks 13-1-1, 13-1-2, 13-1-3, 13-1-4, & 13-1-5, as applicable).

Remove plug and reconnect aircraft bleed air tube to mixing valve inlet.

Perform a start to verify satisfactory operation.

---

**St-7 5B**

Remove plug and reconnect aircraft bleed air tube to mixing valve inlet.

Attempt a start and determine whether slow/stagnated starts still occur.

Start satisfactory?

- **No**
  - Return to service

- **Yes**
  - Repair or replace aircraft heater mixing valve IAW (Similar to TM 55-1520-248-23, Tasks 13-1-1, 13-1-2, 13-1-3, 13-1-4, & 13-1-5, as applicable).
  - Perform a start to verify satisfactory operation.
  - Return to service

---

23 Sep 1997
Rev. A 9 Jan 1998
St-7. Lights Off But Does Not Accelerate
To Idle At Normal Rate

St-7 5C

- Remove the air induction cowl IAW (Similar to TM55-1520-248-23, Task 4.2.1).
- Inspect the compressor inlet for damaged inlet guide vanes or rotor vanes, and for eroded shroud coating at the rotor vane tips.

Compressor damage or erosion noted?

No

St-7 6A (Pg 9)

Yes

- Remove engine IAW (Similar to TM55-1520-248-23, Task 4-1-1).
- Reinstall engine IAW (Similar to TM55-1520-248-23, Task 4-1-2).
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW MTI-2840-263-23, 72-00-00, para 1.B, Diffuser Vent Orifice Selection.

Return to service

23 Sep 1997
Rev. A 9 Jan 1998
St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

St-7

Was HMU changed earlier in this procedure?

Yes

Remove and Replace HMU
IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.
Attempt a start and determine whether slow/stagnated starts still occur.

No

Start satisfactory?

Yes

Return to service

No

Was ECU changed earlier in this procedure?

Yes

Remove and Replace ECU
IAW (Similar to TM55-1520-248-23, Tasks 9-7-2 and 9-7-3).
Attempt a start and determine whether slow/stagnated starts still occur.

No

Remove and Replace engine
IAW (Similar to TM55-1520-248-23, Tasks 4-1-1 and 4-1-2).

Start satisfactory?

Yes

Return to service

No

23 Sep 1997
Rev. A 9 Jan 1998
During starting, the FADEC controls Ng acceleration rate, from lightoff to ground idle. If MGT exceeds 1300°F (794°C), the acceleration rate is decreased. Starts are automatically aborted if MGT exceeds 1550°F (843°C), except at altitudes above 10,000 ft, or when MGT immediately before lightoff is above 180°F (82°C), in which cases the abort temperature is 1700°F (927°C).

Factors which could cause high starting MGT are:
- ECU
- HMU
- Insufficient fuel drainage time since last start
- High residual MGT at start initiation
- Low battery
- Degraded starter
- Faulty fuel nozzle
- Excessive compressor bleed or air leakage

If hot starts are experienced, proceed as follows to correct condition:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether hot starts still occur.

Went ECU or HMU replaced?

Was subsequent start OK?

Return to service

Was motoring speed satisfactory?

No

- Remove and replace starter-generator
  IAW (Similar to TM 55-1520-248-23, Task 9-3-15).
  - Recheck motoring speed to verify at least TBD% Ng.

Yes

Was motoring speed satisfactory?

No

- Remove and replace battery IAW (Similar to TM 55-1520-248-23, Task 9-3-4).
  - Recheck motoring speed to verify at least TBD% Ng.

Yes

Minimum acceptable speeds are:
- APU TBD% Ng
- Battery TBD% Ng

Was APU used?

Yes

No

St-8 A (Pg 2)

St-8 B (Pg 2)
St-8. MGT Too High During Start

St-8 A
- Remove and replace starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15).
- Recheck motor ing speed to verify at least TBD% Nq.

St-8 B
Verify engine anti-icing (ENG ANTI-ICE) and cabin heater (HTR) switches in OFF position. Attempt a start and determine whether hot starts still occur.

St-8 AA
(Pg 3)

St-8 B

Fuel nozzle flow pattern OK?
- Yes
  - Install fuel nozzle IAW TMI-2840-263-23, 73-10-03, para 1.B. Select spacers to provide a D dimension as close to the allowable maximum as possible.
  - Attempt a start and determine whether hot starts still occur.
  - Start satisfactory?
    - Yes
      - Return to service
    - No
      - Return to service

- No
  - Replace fuel nozzle IAW TMI-2840-263-23, 73-10-03, para 1.B. Select spacers to provide a D dimension as close to the allowable maximum as possible.
  - Attempt a start and determine whether hot starts still occur.
  - Start satisfactory?
    - Yes
      - Return to service
    - No
      - Return to service
ST-8

AA

Excessive air bleed or air leakage from the compressor, or between the compressor and turbine, may be the cause of the problem. Different means will be used to search for the leakage, depending on whether the engine can reach ground idle conditions without exceeding limits.

Viably inspect the following areas for evidence of air leakage, cracks, or looseness, and, if observed, make repairs IAW the referenced tasks in MTI-2840-263-23:

- COMPRESSOR SCROLL -- include flanges for aircraft bleed air off-take and unused bleed air off-take. Leakage from cracks in scroll, or from scroll-to-shroud or scroll-to-rear diffuser flanges are cause for compressor module replacement, which requires engine removal and reinstallation. Repair allowable leaks - Para 3.D., and (Similar to TM 55-1520-248-23, Task 4-1-5). Remove engine/replace compressor module/reinstall engine - Para 1.A., 1.B.; and (Similar to TM 55-1520-248-23, Tasks 4-1-1 & 4-1-2).
- AIRCRAFT BLEED AIR TUBE, from compressor scroll to heater mixing valve -- Visually inspect as well as check for looseness. Remove/repair/reinstall IAW (Similar to TM 55-1520-248-23, Tasks 4-1-5, 13-1-13, & 13-1-14).

Can engine reach idle without exceeding limits?

Yes → Start engine and stabilize at ground idle.

No → Inspect for air leakage in the following areas and, if located, make repairs IAW the referenced tasks in MTI-2840-263-23:

- COMPRESSOR SCROLL -- include flanges for aircraft bleed air off-take and unused bleed air off-take. Leakage from cracks in scroll, or from scroll-to-shroud or scroll-to-rear diffuser flanges are cause for compressor module replacement, which requires engine removal and reinstallation. Inspect - Para 3.D. Repair allowable leaks, - Para 3.D., and (Similar to TM 55-1520-248-23, Task 4-1-5). Remove engine/replace compressor module/reinstall engine - Para 1.A., 1.B.; and (Similar to TM 55-1520-248-23, Tasks 4-1-1 & 4-1-2).

St-8 AA

(Pg 4)
St-8. MGT Too High During Start

While operating at ground idle, inspect anti-icing system solenoid valve, tube from solenoid valve to anti-icing valve, and anti-icing valve body and mounting flange for leakage, IAW TMI-2840-263-23, 75-10-01, para 3.A. and 3.B. Verify function of solenoid valve by cycling anti-icing system ON - OFF and observing change in flow rate from solenoid valve vent (decreases when OFF is selected). Correct leaks or malfunctions IAW TMI-2840-263-23, 75-10-01, para 2.A., 2.B., 3.A. and 3.B., as applicable.

Reinstall tube between anti-icing valve and front support.
Isolate aircraft heater by disconnecting aircraft bleed air tube at heater mixing valve inlet and plugging end of tube.

Attempt a start and determine whether hot starts still occur.

Start satisfactory?

Yes

St-8 AAA

No

Replace anti-icing valve IAW TMI-2840-263-23, 75-10-01, para 2.A. and 2.B.

Reinstall tube between anti-icing valve and front support.

Test anti-icing system IAW TMI-2840-263-23, 75-10-01, para 3.B.

Start satisfactory?

Yes

No

Return to service

Isolate the anti-icing system by removing the tube between the anti-icing valve and the front support, and capping the exposed fittings on both the anti-icing valve and the front support.

Start satisfactory?

Yes

Find and correct any leaks or malfunctions?

No

Replace anti-icing valve IAW TMI-2840-263-23, 75-10-01, para 2.A. and 2.B.

Start satisfactory?

Yes

No

Replace upper and lower bleed air tubes and engine deck union.
Using new flange gasket, reconnect scroll end of tube IAW (Similar to TM 55-2840-256-23, Task 4-1-5). Install plug in heater mixing valve end of tube.

Attempt a start and determine whether hot starts still occur.

Start satisfactory?

Yes

No


Replace upper and lower bleed air tubes and engine deck union.
Using new flange gasket, reconnect scroll end of tube IAW (Similar to TM 55-2840-256-23, Task 4-1-5). Install plug in heater mixing valve end of tube.

Start satisfactory?

Yes

No

Remove plug from lower end of bleed air tube and reconnect to heater mixing valve.

23 Sep 1997
Rev. A 9 Jan 1998
St-8. MGT Too High During Start

St-8 AAAA

- Repair or replace aircraft heater mixing valve IAW (Similar to TM 55-1520-248-23, Tasks 13-1-1, 13-1-2, 13-1-3, 13-1-4, & 13-1-5, as applicable).
- Remove plug and reconnect aircraft bleed air tube to mixing valve inlet.
- Perform a start to verify satisfactory operation.
- Return to service

St-8 BBBB

- Remove plug and reconnect aircraft bleed air tube to mixing valve inlet.
- Attempt a start and determine whether hot starts still occur.
- Start satisfactory?
  - No
  - Repair or replace aircraft heater mixing valve IAW (Similar to TM 55-1520-248-23, Tasks 13-1-1, 13-1-2, 13-1-3, 13-1-4, & 13-1-5, as applicable).
  - Perform a start to verify satisfactory operation.
  - Return to service
  - Yes
  - Return to service
St-8. MGT Too High During Start

St-7
6A

Was HMU changed earlier in this procedure?

Yes

No

Remove and Replace HMU
IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.
Attempt a start and determine whether hot starts still occur.

Start satisfactory?

Yes

Return to service

No

Was ECU changed earlier in this procedure?

Yes

Remove and Replace engine
IAW (Similar to TM55-1520-248-23, Tasks 4-1-1 and 4-1-2).

Start satisfactory?

Yes

Return to service

No

Remove and Replace ECU
IAW (Similar to TM55-1520-248-23, Tasks 9-7-2 and 9-7-3).
Attempt a start and determine whether hot starts still occur.

Remove and Replace engine
IAW (Similar to TM55-1520-248-23, Tasks 4-1-1 and 4-1-2).
During starting, the FADEC controls N\textsubscript{g} acceleration rate, from lightoff to ground idle. If MGT exceeds 704°C (1300°F), the acceleration rate is decreased. If MGT is below 704°C, start times to ground idle should be on the order of 30 seconds [TBD]. If start times in that vicinity are accompanied by very low MGT values (538°C [1000°F] or less), there is probably an MGT measurement error. If a slow start time accompanies the low MGT, other factors may be involved, and should be resolved IAW procedures delineated in troubleshooting sequence St-7 (Lights Off But Does Not Accelerate To Idle At Normal Rate). One or more of the following items are probably responsible for the problem:

- ECU
- HMU
- Engine thermocouple harness
- Engine electrical harness
- Engine accessory harness
- Aircraft MGT indicator

If very cool starts are experienced, proceed as follows to correct condition:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether cool starts still occur.

Field-check the calibration of the cockpit MGT indicator as follows:

- Remove the two nuts from the MGT harness terminal block studs and lift off MGT harness leads (but leave signal leads from engine electrical harness and engine accessory harness attached to the studs).
- Using Thermocouple Calibrator (OMEGA Model CL-300-1000C-K TBD or equivalent), attach the chromel lead of the calibrator to the chromel terminal stud and the alumel terminal lead to the alumel terminal block stud.
- Reinstall the stud nuts, and torque to 18-24 in.-lb.
- Power up the aircraft with battery or APU.
- Connect Maintenance Terminal and set up to display real time analog parameters.
- Set thermocouple calibrator to 600°C (1112°F) and observe and record MGT value displayed on the cockpit MGT indicator and on the Maintenance Terminal MGT display.
- Repeat above steps at calibrator settings of 500°C (932°F) and 700°C (1292°F).
- MGT indications from cockpit digital MGT indicator and Maintenance Terminal should agree with the thermocouple calibrator within ±TBD °C (±TBD°F).
St-9. MGT Too Low During Starts

St-9 A

Cockpit & Maint. Term. agree w/ calibrator?

Yes

Yes

Maint. Term. agree w/ calibrator?

No

No

Inspect accessory harness IAW TMI-2840-263-23, 73-21-00, para 6.A.

Accessory harness check out OK?

Yes

Remove and replace engine accessory harness IAW MTI-2840-263-23, 73-21-00, para 3.A. and 3.B.

No

St-9 AA (Pg 2)

St-9 BB (Pg 2)

Reconnect engine electrical harness and accessory harness MGT leads to the MGT terminal block (MGT harness leads still disconnected). Repeat the checks at 600°C, 500°C and 700°C with the thermo-couple calibrator.

No

Cockpit agree w/ calibrator?

Yes

Replace cockpit MGT indicator IAW (Similar to TM 55-1520-248-23, Tasks 8-1-9), recalibrate IAW [TBD].

Yes

Replace cockpit MGT indicator IAW (Similar to TM 55-1520-248-23, Tasks 8-1-9).

St-9 AA (Pg 2)

St-9 BB (Pg 2)

Remove calibrator and reconnect MGT harness leads to terminal block, along with engine electrical and accessory harness MGT leads, and torque stud nuts to 18-24 in.-lb.

Attempt a start and determine whether cool starts still occur.

Start satisfactory?

Yes

Return to service

No

St-9 CC (Pg 3)

24 Sep 1997
Rev. A 15 Jan 1998
St-9. MGT Too Low During Starts

Was HMU changed earlier in this procedure?

- Yes
  - Remove and Replace HMU
    IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.
    Attempt a start and determine whether cooling starts still occur.

- No
  - Return to service

Was ECU changed earlier in this procedure?

- Yes
  - Remove and Replace engine
    IAW (Similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).

- No
  - Remove and Replace ECU
    IAW (Similar to TM 55-1520-248-23, Tasks 9-7-2 and 9-7-3).
    Attempt a start and determine whether cooling starts still occur.

Start satisfactory?

- Yes
  - Return to service

- No
  - Remove and Replace engine
    IAW (Similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).
During starting, positive main oil pressure should be observed by the time Ng reaches Ground Idle speed (nominally 64%), and should stabilize at 50 to 130 psig at Ground Idle.

If no indication of main oil pressure occurs by the time Ground Idle is reached, the start must be aborted and the cause investigated and corrected. Causes of the problem may be as follows:

- Failure of the oil pump to prime
- Restriction in oil pump supply line
- Insufficient amount of oil in oil tank
- Dirty main oil filter
- Faulty aircraft main oil pressure sensor or indicator
- Leaking O-ring on oil filter housing check valve or transfer tube
- Stuck oil pressure regulating valve
- Failed oil pump or oil pump drive
- Other accessory gearbox fault

If a main oil pressure indication is observed by the time Ground Idle is reached but it stabilizes at less than 50 psig, resolve IAW procedures delineated in troubleshooting sequence R-16 (Oil Pressure Too Low). If no main oil pressure is observed by the time Ground Idle is reached, proceed as follows to correct.
St-10. No Oil Pressure Indicated During Start

**St-10 A**
Troubleshoot cockpit oil pressure indicator and related aircraft wiring (similar to TM 55-1520-248-23, Appendix K, Section III).

**St-10 B**
Remove pressure gage and tee fitting from main oil pressure sense line. Loosen fitting at oil pressure transducer inlet and motor engine to bleed pressure sense line.

**St-10 C**
Remove pressure gage and tee fitting from main oil pressure sense line. Loosen fitting at oil pressure transducer inlet and motor engine to bleed pressure sense line.

Remove oil filter housing and check valve IAW TM 1-2840-263-23, 72-60-00, para 1.D. and 2.D. Remove transfer tubes and inspect O-rings on both ends, as well as check valve O-rings. Reinstall oil filter housing, transfer tubes, and check valve per para 2.F., using all new O-rings and gasket.

Perform engine start to verify proper main oil pressure.

Main oil pressure OK?

- **Yes**
  - Adjust oil pressure regulating valve IAW TM 1-2840-263-23, 72-60-00, para 3.A.
  - Return to service

- **No**
  - Perform engine start to verify proper main oil pressure
  
  Main oil pressure OK?
  
  - **Yes**
    - Return to service
  
  - **No**
    - Return to service

Remove and inspect oil pressure regulator valve assembly (similar to TM 55-2840-256-23, Tasks 6-2-5 and 6-2-6). Repair as needed and reinstall per Tasks 6-2-7 and -8.
St-11. No Rotation Of Nr/Np By 25% Ng During Start

During engine starts, rotation of the aircraft rotor should begin by the time Ng reaches 25%. If no rotation, the start must be aborted and the cause investigated.

Possible causes for the problem include the following:
- Improper oil type in cold weather
- Excess drag in aircraft power train
- Rub or drag in engine power turbine system
- Accessory gearbox internal fault

If this problem is encountered, proceed as follows:

Was oil changed to MIL-L-7808G?

Able to rotate engine?

Troubleshoot and repair aircraft power train IAW (Similar to TM 55-1520-248-23, Chapter 6).

Return to service

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove turbine module IAW TMI-2840-263-23, 72-00-00, para 1.A.
- Check power turbine rotor for freedom of rotation.

Did rotor rotate freely or become free?

Return to service

Start satisfactory?

Start satisfactory?

Return to service

Verifying from engine log book that oil conforming to MIL-L-7808G is being used in the engine. If not, change oil to MIL-L-7808G IAW TMI-2840-263-23, 72-00-00, para 8.D. Engine Servicing. This includes draining and servicing the engine oil system IAW (Similar to TM 55-1520-248-23, Tasks 1-4-5 and 1-4-5.1).

19 Sep 1997
Rev. A 19 Jan 1998

EDR 18882
St-11. No Rotation Of Nr/Np By 25% Ng During Start

St-11 B

Power turbine rotor rotates freely?

Yes

Replace Accessory Gearbox
IAW TMI-2840-263-23, 72-60-00, para 1.A.

No

St-11 C

Remove engine IAW
(Similar to TM 55-1520-248-23, Task 4-1-1).

Replace Turbine Module
IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B.

- Reinstall engine IAW
  (Similar to TM 55-1520-248-23, Task 4-1-2).
- Service engine oil system IAW (Similar to TM 55-1520-248-23, Tasks 1-4-5 and 1-4-5.1, and TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing.

Return to service
St-12. Does Not Motor To Required Lightoff Speed

During starting, the FADEC introduces fuel at 12% Ng (10% Ng at ambient temperatures below 20°F [-6.7°C]). If the maximum available motoring speed is less than these speeds, there will be no fuel flow and thus the engine will not light off. The starter should be able to motor the engine to at least 15% Ng at 20°F and above, and to 12% Ng below 20°F.

Possible causes for low motoring speed are:
- Low battery
- Degraded starter
- Aircraft electrical system problems
- Mechanical drag or rub in gas generator rotor
- Excess oil in accessory gearbox creating drag on gears

If low motoring speed is encountered, proceed as follows:

- Power up aircraft electrical system IAW (Similar to TM 55-1520-248-23, Task 9-3-10).
- On Multi-Parameter Display (MPD) unit, select BATT V - START V, to allow monitoring of battery and starter voltages.
- Pull IGN circuit breaker on forward overhead console panel and set twist grip to cutoff position.

- Engage starter and determine maximum available motoring speed.
- Note battery voltage prior to starter engagement and starter voltage at maximum cranking speed.
- Disengage starter and, during coast-down, listen for heavy rubbing noises from the engine and observe for an unusually rapid stop.

Heavy rub or rapid coastdown?

Was battery voltage too low?

Battery voltage before starter engagement should be at least TBD volts, and starter voltage at maximum cranking speed should be between TBD and TBD volts

Starter voltage too low?

Was battery voltage too low?

Remove and replace battery IAW (Similar to TM 55-1520-248-23, Task 9-3-4).

Return to service

Troubleshoot and repair aircraft starter electrical system, IAW TM 55-1520-248-23, Appendix K, Section IV.

Motor to verify at least minimum required Ng.

Return to service

Remove and replace starter-generator IAW (Similar to TM 511520-248-23, Task 9-3-15).

Motor to verify at least minimum required Ng.

17 Sep 1997
Rev. A 20 Jan 1998
St-12. Does Not Motor To Required Lightoff Speed

St-12 A
Remove starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15)
Insert engine turning tool into starter drive pad and rotate gas generator gear train and rotor system by hand to confirm heavy rub condition.

St-12 B
Remove bottom magnetic (Magnetic Plug) IAW TMI-2840-263-23, 72-60-00, para 4.B.
Catch and measure amount of oil drained.

Amount drained less than 100 ml?
Yes

No

Reinstall bottom chip detector (magnet plug) temporarily, immediately motor engine and determine maximum available speed.

Was motoring speed satisfactory?

Yes

St-12 AA (Pg 3)
Complete installation of bottom magnetic plug IAW TMI-2840-263-23, 72-60-00, para 1.D.

Remove oil filter housing and check valve IAW TMI-2840-263-23, 72-60-00, para 1.D.
Remove transfer tubes and inspect O-rings on both ends, as well as check valve O-rings.
Reinstall oil filter housing, transfer tubes, and check valve per para 2.F., using all new O-rings and gasket.

Recheck motoring speed to verify at least minimum required Ng.

Was motoring speed satisfactory?

No

Return to service

Yes

Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).

Replace Accessory Gearbox IAW TMI-2840-263-23, 72-60-00, para 1.A. and 2.F.

• Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
• Service engine oil system IAW (Similar to TM 55-1520-248-23, Tasks 1-4-5 and 1-4-5.1), and TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing.

Return to service

17 Sep 1997
Rev. A 20 Jan 1998
St-12. Does Not Motor To Required Light Off Speed

Complete installation of bottom (magnetic plug) IAW TMI-2840-263-23, 72-60-00, para 4.B.

Was battery changed earlier in this procedure?

No

Remove and replace battery IAW (Similar to TM 55-1520-248-23, Task 9-3-4).

Recheck motoring speed to verify at least minimum required Ng.

Was motoring speed satisfactory?

No

Yes

Return to service

Was starter changed earlier in this procedure?

No

Remove and replace engine IAW (Similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).

Remove and replace starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15).

Recheck motoring speed to verify at least minimum required Ng.

Was motoring speed satisfactory?

No

Return to service

Yes

Remove and replace engine IAW (Similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).

17 Sep 1997
Rev. A 20 Jan 1998
Failure of the engine to rotate when the starter is selected ON electrically can be caused by the following situations or conditions:

- Starter failed electrically
- Starter failed mechanically
- No electrical power to starter
- Gas generator rotor mechanically dragging or seized
- Gas generator rotor frozen by ice
- Accessory gearbox internal failed

If engine does not rotate when the starter is selected ON, proceed as follows to resolve the problem:

- Power up aircraft electrical system IAW (Similar to TM 55-1520-248-23, Task 9-3-10).
- On Multi-Parameter Display (MPD) unit, select BATT V - START V, to allow monitoring of battery and starter voltages.
- Pull IGN circuit breaker on forward overhead console panel and set twist grip to cutoff position.
- Engage starter switch.
- Note battery voltage prior to starter engagement and starter voltage with starter switch ON.
- Observe starter, particularly the starter cooling fan, for motion or other response as the starter switch is turned ON.

Select starter OFF after observing voltages and starter response

Did starter rotate freely? Yes

Start drive shaft failed? No

Did fan twitch or starter buzz? Yes

Install replacement starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15).

Motor to verify proper engine rotation. Return to service

Troubleshoot and repair aircraft starter electrical system, IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).

Motor to verify proper engine rotation. Return to service

Remove and replace starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15).
St-13. Starter Will Not Rotate Engine

**St-13 A**

1. Ambient temperature above 32°F (0°C)?
   - Yes: Use heater to flow warm air through engine long enough to be sure any ice in inlet or engine is melted.
   - No: Attempt to motor engine to verify freedom of rotation and motoring capability.

2. Motor satisfactory?
   - Yes: Return to service
   - No: Remove starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15).

3. Insert engine turning tool into starter drive pad and attempt to rotate gas generator gear train and rotor system by hand to confirm seizure of gas generator rotor.

**St-13 B**

1. Replace Accessory Gearbox
   - IAW TMI-2840-263-23, 72-60-00, para 1.A.

2. Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
3. Service engine oil system IAW (Similar to TM 55-1520-248-23, Tasks 1-4-5 and 1-4-5.1) and MTI-2840-263-23, 72-00-00, para 8.A. Lubrication System Servicing.

4. Return to service

---

20 Sep 1997
Rev. A 20 Jan 1998
R-1. Anti-icing System Operating Improperly

Several faults can affect anti-icing system function. Some leave the system ON at all times, some degrade its performance, others render it nonfunctional. These include:
- Loss of electrical power to A/I solenoid valve (results in system ON)
- A/I air valve to solenoid valve tube loose/broken (results in system ON)
- A/I air valve to front support tube loose/broken (results in reduced or no icing protection of engine inlet)
- Dirt obstructing vents at trailing edge of inlet guide vanes (results in reduced icing protection of inlet guide vanes)
- A/I solenoid valve vent plug plugged or obstructed (results in system OFF)
- A/I air valve stuck closed (results in system OFF)

If anti-icing system function is in question, proceed as follows to verify and correct if required:

Test anti-icing system IAW TMI-2840-263-23, 75-10-01, para 3.A. and 3.B.
This test verifies proper system function, proper function of the A/I solenoid valve, and identifies electrical power problems.

Did A/I ON increase MGT 5°C to 15°C?
- Yes: Return to service
- No:

Any MGT rise at all when A/I selected ON?
- Yes: Troubleshoot and repair related aircraft electrical circuitry IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).

Solenoid valve function OK during system test?
- Yes: Upon satisfactory completion
- No: Return to service

Solenoid valve electrical power supply OK?
- No:

Power down aircraft IAW (Similar to TM 55-1520-248-23, Task 9-3-11).
- Disconnect aircraft connector P16 at engine accessory harness connector J16.
- Power up aircraft IAW (Similar to TM 55-1520-248-23, Task 9-3-10).
- Using multimeter, measure DC voltage between pin U (hot) and pin T (ground) on aircraft connector.

14-28 volts DC measured?
- Yes: Troubleshoot engine accessory harness to correct continuity problem between interface connector J16, pin U, and A/I solenoid valve connector P13, pin 1, and between J16, pin T, and P13, pin 2. If necessary, remove, test, and reinstall or replace accessory harness IAW.
R-1. Anti-icing System Not Operating Properly

R-1 A

A/I system related MGT rise less than 5°C

Yes

Inspect anti-icing system for leaks IAW TM 55-2840-256-23, Task 9-1-1. Make repairs as needed.

No

Remove tube (A/I air valve to front support) and connect auxiliary regulated air supply to A/I air inlet fitting on front support. Block off A/I air exit hole on front of bullet nose. Blow air through A/I passages at 40 PSIG, maximum, to dislodge dirt from inlet guide vane trailing edge slots. Restore to normal configuration, including unblocking A/I air holes in bullet nose.

R-1 B

Remove and Replace Anti-icing Air Valve Assembly
IAW TMI-2840-263-23, 75-10-01, para 2.A. and 2.B.


Upon satisfactory completion

Return to service

R-1 C

Remove and Replace Anti-Ice Solenoid Valve
IAW TMI-2840-263-23, 75-10-01, para 2.C. and 2.D.

Compressor surge/stall during Ng accelerations may result from any of the following:

- ECU
- HMU
- Compressor inlet blockage
- Compressor inlet air temperature or pressure distortion
- Inducer bleed restriction or disconnection
- Compressor inlet or diffuser damage, rub, or erosion

If surges are suspected, connect Maintenance Terminal and check Maintenance History, Pg 2 of 2, for Surge Counter (SgCtr) reading to verify. The counter increases its indication by 1 each time a surge is sensed by the FADEC. Also read Maintenance Terminal for fault indications, and correct as required to clear.

Insofar as possible, conduct subsequent engine diagnostic running with aircraft headed into wind to rule out exhaust gas ingestion as a cause of the surges.

If ECU or HMU were replaced as a result of clearing faults, operate the engine under conditions that produced the surges to determine whether condition still exists.

- Remove the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
- Inspect the compressor outlet for blockage or obstruction.
- Inspect the inlet particle separator panels and tubes for damage or blockage.
- Inspect compressor for damage to inlet guide vanes or impeller vanes, or rub or erosion of shroud lining in vicinity of impeller vane tips.

Was ECU or HMU replaced?

- No
- Yes

Subsequent operation satisfactory?

- No
- Yes

Return to service

Inspect inducer bleed duct for security of attachment at both ends and freedom from restriction (Ref. Similar to TM 55-1520-248-23, Task 2-1-24). Correct as required.

Compressor inlet blockage noted?

- No
- Yes

Inlet particle separator blockage noted?

- No
- Yes

Compr inlet damage, rub, or erosion noted?

- No
- Yes

Engine operation satisfactory?

- No
- Yes

Return to service

29 Sep 1997
Rev. A 21 Jan 1998
R-2. Compressor Surge/Stall

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Identify replaced compressor module as having been subjected to inlet blockage and send to overhaul.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Correct inlet particle separator blockage condition IAW
(Similar to TM 55-1520-248-33, Tasks 4-2-8, -9, and -10).

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-10).
- Identify replaced compressor module as having been subjected to inlet blockage and send to overhaul.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

The flow path must be inspected for debris and damage from particles generated by compressor:
- Remove combustion module IAW TMI-2840-263-23, 72-40-00, para 1.A and 2.A.
- Inspect air discharge tubes, combustion outer case, and liner IAW TMI-2840-263-23, 72-40-00, para 1.C., 2.B., and 4.C., respectively.
- Inspect first stage nozzle shield, nozzle, and turbine wheel IAW TMI-2840-263-23, 72-50-00, para 5.C. and 5.D.
- Install first stage nozzle shield (replace existing part if condition requires).
- If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B. (or replace).
- If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C., (or replace).

Return to service

Return to service

Rev. A 21 Jan 1998
Rev. 11 Jul 99
R-2. Compressor Surge/Stall

- Reinstall turbine module IAW TMI-2840-263-23, 72-50-00, para 1.B., and combustion module per TMI-2840-263-23, 72-40-00, para 1.B. and 2.A.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

This branch considers compressor diffuser damage not visible externally:
- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).

The flow path must be inspected for debris and damage from particles generated by compressor:
- Remove combustion module IAW TMI-2840-263-23-40-00, para 1.A and 1.B.
- Inspect air discharge tubes, combustion outer case, and liner IAW TMI-2840-263-23, 72-40-00, para 1.C., 2.B. and 4.C. respectively.
- Inspect first stage nozzle shield, nozzle, and turbine wheel IAW TMI-2840-263-23, 72-50-00, para 5.C. and 5.D.
- Install first stage nozzle shield (replace existing part if condition requires).
- If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B. (or replace).
- If required, make repairs to combustion liner IAW TMI-2840-263-23, 73-40-00, para 1.C. (or replace).

Return to service

- Reinstall turbine module IAW TMI-2840-263-23, 72-50-00, para 1.B., and combustion module per TMI-2840-263-23, 72-40-00, para 1.B. and 2.A.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Return to service

29 Sep 1997
Rev. A 21 Jan 1998
Sparks in the engine exhaust during engine operation can be caused by several different conditions, such as:

- Compressor rubbing from bearing failure, or from ingestion damage
- Damage to the turbine section from localized hot spot, rubbing, ingestion damage or other causes
- Carbon building and shedding in the combustor as a result of a faulty fuel nozzle spray pattern, or of combustor damage
- Molten metal from combustion liner as a result of faulty fuel nozzle spray pattern or inadequate surface cooling due to local damage.

If sparks are being emitted from the engine exhaust, proceed in the following sequence to identify the cause and correct the problem:

- Remove the air induction cowling IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
  - Inspect compressor for damage to inlet guide vanes or impeller vanes, or rub of shroud lining in vicinity of impeller vane tips.
  - Inspect compressor rotor for radial looseness at No. 1 bearing location.

- Remove combustion module IAW TMI-2840-263-23, 72-40-00, para 1.A and 2.A.
  - Inspect air discharge tubes, combustion outer case, and liner IAW TMI-2840-263-23, 72-50-00, para 5.C and 5.D., respectively.
  - Inspect first stage nozzle shield, nozzle, and turbine wheel IAW TMI-2840-263-23, 72-50-00, para 5.C and 5.D.

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
  - Has engine been removed from aircraft?
    - Yes
      - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
    - No
      - Remove and replace turbine module IAW TMI-2840-263-23, 72-50-00, 1.A. and 1.B.

- Liner damage beyond TMI-263-23, 72-40-00, para 1.C. limits?
  - Yes
    - Replace combustion liner
  - No
    - Replace combustion liner

30 Sep 1997
Rev. A 24 Jan 1998
R-3. Exhaust Duct Emitting Sparks

- Reinstall first stage nozzle shield (replace existing part if condition requires). Ref. TMI-2840-263-23, 72-50-00, para 5.D.
- If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B. (or replace).
- If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. (or replace).

Reinstall combustion module IAW TMI-2840-263-23, 72-40-00, para 1.B. and 2.A.

Has engine been removed from aircraft?

Yes

Reinstall engine IAW TMI-2840-263-23, 72-40-00, para 1.B. and 2.A.

No

Fuel nozzle flow pattern OK?

Yes

Install fuel nozzle IAW TMI-2840-263-23, 73-10-03, para 1.B.

No

Was compressor replaced during this sequence?

Yes

As a part of the check runs accompanying engine installation (TMI-2840-263-23, 72-00-00, para 1.B. 1.A., Operating Instructions Task 4-1-2), check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove, and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B. Diffuser Vent Orifice Selection.

No

Replace fuel nozzle
Install replacement nozzle IAW TMI-2840-263-23, 73-10-03, para 1.A. and 1.B.

Return to service

Remove fuel nozzle, and inspect, service, and inspect flow pattern IAW TMI-2840-263-23, 73-10-03, para 1.A., 2.A. and 3.A., respectively.
Exhaust torching during transients is usually the result of a faulty fuel nozzle or an overly-rich acceleration fuel schedule. Among the causes for a rich fuel schedule are:

- ECU
- HMU
- Excessive bleed air extraction
- Overboard air leakage

If exhaust torching on transients is experienced, proceed as follows to correct the condition:

1. Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, operate the engine under conditions where torching was observed and determine whether it still occurs. Before starting, verify engine anti-icing (ENG ANTICE) and cabin heater (HTR) switches are in OFF position.


   - Anti-icing system function OK?
     - Yes → Operate engine and determine whether torching still occurs.
     - No → Troubleshoot and correct system IAW fault correction procedure R-1 (Anti-icing System Operating Improperly).

3. Operate engine and determine whether torching still occurs.

   - Engine still torching?
     - Yes → Repair or replace aircraft heater mixing valve IAW (Similar to TM 55-1520-248-23, Tasks 13-1-1, 13-1-2, 13-1-3, 13-1-4, & 13-1-5) as applicable. Remove plug and reconnect aircraft bleed air tube to mixing valve inlet.
     - No → Return to service

4. Return to service

   - Engine still torching?
     - Yes → Remove plug and reconnect bleed air tube to cabin heater mixing valve.
     - No → Return to service
R-4. Exhaust Torching During Transients

Start engine and operate at ground idle. Inspect for air leakage in the following areas and, if located, make repairs IAW the referenced tasks in TMI-2840-263-23, 72-30-00:

- **COMPRSSOR SCROLL** — include flanges for aircraft bleed air off-take and unused bleed air off-take. Leakage from cracks in scroll, or from scroll-to-shroud or scroll-to-rear diffuser flanges are cause for compressor module replacement, which requires engine removal and reinstallation. Inspect - Para 3.D.. Repair allowable leaks - and (Similar to TM 55-1520-248-23, Task 4-1-5.) Remove engine/replace compressor module/ reinstall engine - TMI-263-23, 72-30-00, para 1.A. and 1.B., and (Similar to TM 55-1520-248-23, Tasks 4-1-1 & 4-1-2).


Fuel nozzle flow pattern OK?

Yes

Install fuel nozzle IAW TMI-2840-263-23, 73-10-03, para 1.B.

No

Replace fuel nozzle install replacement nozzle IAW TMI-2840-263-23, 73-10-03, para 1.B.

Was compressor replaced during this sequence?

Yes

No

R-4 BB (Pg 3)

R-4 AA (Pg 3)

Were leaks detected and corrected?

Yes

R-4 AA (Pg 3)

No

30 Sep 1997
Rev. A 26 Jan 1998
R-4. Exhaust Torching During Transients

R-4 AA

Operate engine and verify that torching no longer occurs.

Return to service

R-4 BB

As a part of the check runs accompanying engine installation TMI-2840-263-23, 72-00-00, para 1.A., Check Run, Operating Instructions. Check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Orifice Selection.

Operate engine and verify that torching no longer occurs.

Return to service

30 Sep 1997
Rev. A 26 Jan 1998
Fuel leakage from the HMU seal drain port is permissible at rates up to 10 drops per minute.

If leakage from the HMU drain port is observed, proceed as follows:

- Operate the engine at Ground Idle, with the fuel boost pump ON.
- Determine the leakage rate from the HMU drain port, in drops per minute.
- Capture a sample of the leakage, and determine whether the fluid is fuel, oil, or a mixture (since the possibility exists for both to leak into the same seal drain cavity).

Recheck HMU drain port leakage at Ground Idle to verify rate is within 10 drops per minute limit.

Return to service

Remove and Replace HMU IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.

Return to service

30 Sep 1997
Rev. A 26 Jan 1998
R-6. Ground Idle Speed Too High Or Too Low

Ground Idle gas generator speed (Ng) is NOT adjustable, nor is there a speed modulation range below Ground Idle. If the throttle lever angle on the HMU is between 12° and 40°, Ng must be 64% ± TBD%. If not within this speed band, maintenance action is required.

Likely causes of improper Ng at Ground Idle are:
- Misrigging of the twist grip to HMU throttle linkage
- Cockpit Ng instrumentation error
- HMU
- ECU

If an out-of-limits Ground Idle Ng condition is encountered, connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, perform a start to Ground Idle twist grip position and determine whether Ng is within required speed band.

Were ECU or HMU replaced?

Yes

Return to service

No

Inspect HMU control rigging IAW TMI-2840-263-23, 73-21-01, para 1.D. and adjust as required IAW (Similar to TM 55-1540-248-23, Task 4-6-1).

Was rerigging necessary?

Yes

Perform a start to Ground Idle twist grip position and determine whether Ng is within required speed band

Is Ground Idle Ng OK?

Yes

Return to service

No

No

• Select Real Time Analog Data display page on Maintenance Terminal.
• Perform a start to Ground Idle twist grip position.
• Read and compare Ng indication from cockpit speed indicator and from Maintenance Terminal.

Does cockpit Ng agree with Maint Terminal?

Yes

Replace or repair Multiparameter Display Ng channel IAW (Similar to TM 55-1520-248-23, Tasks 8-1-5, 8-1-6, 8-1-7, and 8-1-8).

Perform a start to Ground Idle twist grip position and verify that Ng is within required speed band.

Return to service

1 Oct 1997
Rev. A 26 Jan 1998
R-6. Ground Idle Speed Too High Or Too Low

R-6

Remove and Replace ECU
IAW (Similar to TM 55-1520-248-23, Tasks 7-7-2* and 9-7-3).
Perform a start and determine whether Ng is within required speed band.

Is Ground Idle Ng OK?

Yes

Return to service

No

Remove and Replace HMU
IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.
Perform a start and verify that Ng is within required speed band.
The engine is fitted with two magnetic chip detectors, upper and lower. Oil scavenged from the accessory gearbox, which includes all accessory gears and bearings, plus the following main bearings, flows past the lower chip detector.
- No. 2 (rear compressor)
- No. 2½ (spur adapter gearshaft)
- Nos. 3 and 4 (power train pinion gear)
- No. 5 (front power turbine)

Oil flowing past the upper chip detector comprises all oil scavenged from the engine, including the oil that has already flowed past the lower chip detector plus oil from the following main bearings:
- No. 1 (front compressor)
- No. 6 (rear power turbine)
- No. 7 (front GG turbine)
- No. 8 (rear GG turbine)

The non-fuzz-burning chip detectors are connected through the engine accessory harness to an aircraft harness, which transmits chip indications to the Multifunction Display (MFD).

The following sequence presents actions to be taken if engine chip detector CAUTIONS are displayed on the MFD.

**Disconnect engine accessory harness connector from chip detector(s) currently giving chip indication.**

Did chip indication on MFD turn OFF?

- Yes
- No

**Disconnect aircraft interface connector P16 from the engine accessory harness connector J16.**

Did chip indication on MFD turn OFF?

- Yes
- No

**Troubleshoot aircraft wiring (similar to TM 55-1520-248-23, Appendix K, Section IV).**


**Remove and Replace engine accessory harness (similar to TM 55-1520-246-23, Tasks 4-1-1 and 4-1-2).**

- Service aircraft portion of engine oil system IAW TM 1-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing, as applicable.

The below circumstances are cause for engine removal or replacement:
- Four chip detector indications in the last 50 hours of engine operation

**OR**
- A chip detector indication within eight engine operating hours following a post-chip-detection maintenance check run, where a second 30 minute run was necessitated by an indication on the first 30 minute run

**Do either of these cases apply?**

- Yes
- No

**R-7 A**
(Pg 2)

**R-7 B**
(Pg 2)

2 Oct 1997
Rev. A 27 Jan 1998
R-7. Magnetic Chip Detector Warning

R-7 A

- Remove, service, and install chip detectors per TM 1-2840-263-23, 72-60-00, para 4.B.
- In log book, note event as False Indication.

Return to service

R-7 B

Remove and Replace engine
(similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).
- Service aircraft portion of engine oil system IAW TM 1-2840-263-23, 72-00-00, para 8.A., Lubricating System Servicing, as applicable.

Was a second 30 minute run required?

Yes

Chip indication during second run?

No

Yes

- Remove and Replace engine
(similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).
- Service aircraft portion of engine oil system IAW TM 1-2840-263-23, 72-00-00, para 8.A., Lubricating System Servicing, as applicable.

Return to service

- Service and install chip detectors, and perform a 30 minute ground run IAW TM 1-2840-256-23, 72-60-00, para 4.B.

If chips are encountered during the 30 minute run (that do not exceed size or count limits):

- Remove, clean, and reinstall chip detectors per para 4.B.
- Clean engine oil filter per para 1.C.
- Service aircraft portion of engine oil system per TM 1-2840-263-23, 72-00-00, para 8.A., Lubricating System Servicing, as applicable.
- Make a second 30 minute ground run per TM 1-2840-256-23, 72-60-00, para 4.B.

Particle sizes or counts exceed limits?

No
R-8. Low Measured MGT At Normal Or High Power

Abnormally low measured MGT with other engine parameters (such as Ng and torque) being in the normal range is usually caused by such items as:

- Aircraft MGT indicator
- Engine thermocouple harness
- Engine electrical harness
- Engine accessory harness

If an abnormally low MGT condition is encountered, proceed as follows to correct:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the MGT harness, the engine electrical harness, or the engine accessory harness were replaced as a result of clearing these faults, make an engine run to determine whether MGT now appears normal.

MGT indication satisfactory?

Yes

Cockpit MGT indicator agrees with calibrator?

Yes

Remove and replace Engine Thermocouple Harness
IAW TM 1-2840-263-23, 77-20-01, para 1.A. and 1.B.

Remove calibrator and reconnect MGT harness leads to terminal block, along with engine electrical and accessory harness MGT leads, and torque stud nuts to 18-24 in.-lb.

Make an engine run to verify that MGT appears normal.

Return to service

Field-check the calibration of the cockpit MGT indicator as follows:

- Remove the two nuts from the MGT harness terminal block studs and lift off MGT harness leads and engine electrical harness leads (but leave signal leads from engine accessory harness attached to the studs).
- Using Thermocouple Calibrator (OMEGA Model CL-300-1000C-K (TBD) or equivalent), attach the chromel lead of the calibrator to the chromel terminal stud and the alumel calibrator lead to the alumel terminal block stud.
- Reinstall the stud nuts, and torque to 18-24 in.-lb.
- Power up the aircraft with battery or APU.
- Set thermocouple calibrator to 800°C (1472°F) and observe and record MGT value displayed on the cockpit MGT indicator.
- Repeat above steps at calibrator settings of 700°C (1292°F) and 600°C (1112°F).
- MGT indications from cockpit digital MGT indicator should agree with the thermocouple calibrator within ± TBD °C (± TBD°F).

No

R-8 A (Pg 2)

MGT or other engine harnesses replaced?

Yes

No

Return to service

3 Oct 1997
Rev. A 27 Jan 1998
R-8. Low Measured MGT At Normal Or High Power

R-8 A

Inspect accessory harness IAW TM1-2840-263-23, 73-21-00, para 3.B.

Accessory harness check out OK?

Yes →

Cockpit MGT indicator agrees with calibrator?

Yes →

Return to service

No →

Troubleshoot and repair aircraft wiring from engine accessory harness interface connector J16, pins L (alumel), M (chromel), and K (shield), to cockpit MGT indicator (similar to TM 55-1520-248-23, Appendix K, Section IV).

Problems detected and corrected?

Yes →

Replace cockpit MGT indicator (similar to TM 55-1520-248-23, Task 8-1-9).

No →

Replace calibrator and reconnect MGT harness leads to terminal block, along with engine electrical and accessory harness MGT leads, and torque stud nuts to 18-24 in.-lb.

No →

Remove and replace Engine Accessory Harness IAW TM 1-2840-263-23, 73-21-00, para 3.A and 3.B.

R-8 AA

(Pg 2)

Make an engine run to verify that MGT appears normal.
Allowable operating limits for gas generator speed (Ng) and power turbine speed (Np), and maintenance actions required upon limits exceedences, are as follows:

**GAS GENERATOR SPEED (Ng)**
- Above 106% or
- 105%-106% over 10 seconds

*Repair/overhaul compressor and turbine*

**POWER TURBINE SPEED (Np)**
- Above 119% (or maximum indication of Np speed indicator), or
- Any time complete loss of output shaft load occurs, or
- Any time maximum allowable Np (adjusted for torque) is exceeded, or
- Any time continuous allowable Np (adjusted for torque) is exceeded for more than 15 seconds

*Repair/overhaul turbine and gearbox*

It is possible, particularly during extreme transient maneuvers, during operation in the FADEC manual mode, or in an event such as an output shaft failure, to exceed these limits.

The ECU captures overspeed events in its memory, the magnitude of which can be accessed with the Maintenance Terminal.

If Ng or Np overspeeds occurred or are suspected, proceed as follows to resolve:

Connect the Maintenance Terminal and select the Maintenance History display. Read out the values of the following parameters:

**NgLmPk** -- the highest Ng reached, if above 106%  
**NgLmTm** -- the time (sec.) above 106% Ng  
**NgRLmPk** -- the highest Ng reached, if above 105%  
**NgRLmTm** -- the time (sec.) greater than 10 seconds that Ng exceeded 105%  
**NpQNPppkExLm** -- the highest Np reached if above maximum allowable Np (adjusted for torque)  
**NpQNPppkRnLm** -- the highest Np reached above the continuous allowable Np (adjusted for torque) limit if exceeded for more than 15 seconds

If NgLmPk is greater than 106%, or if NgRLmTm is greater than 0.000 seconds, a gas generator overspeed has occurred.

If NpQNPppkExLm or NpQNPppkRnLm show values above 107% Np, a power turbine overspeed has occurred.

- Remove engine (similar to TM 55-1520-248-23, Task 4-1-1).  
- Remove and replace Compressor module IAW TM 1-2840-263-23, 72-30-00, para 1.A and 1.B.  
- Remove and replace Turbine module IAW TM 1-2840-263-23, 72-50-00, para 1.A and 1.B.  
- Identify replaced compressor and turbine modules as having been subjected to Ng overspeed and send to overhaul.  
- Reinstall engine (similar to TM 55-1520-248-23, Task 4-1-2).  
- Clear any remaining maintenance alerts not addressed by module changes.  
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TM 1-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

*Return to service*

6 Oct 1997
Rev. A 16 Feb 1998
R-9. Ng Or Np Overspeed

1. Remove engine (similar to TM 55-1520-248-23, Task 4-1-1).
2. Remove and replace Accessory gearbox module IAW TM 1-2840-263-23, 72-60-00, para 1.A.
3. Remove and replace Turbine module IAW TM 1-2840-263-23, 72-50-00, para 1.A. and 1.B.
4. Identify replaced accessory gearbox and turbine modules as having been subjected to Np overspeed and send to overhaul.
5. Reinstall engine (similar to TM 55-1520-248-23, Task 4-1-2).
6. Clear any remaining maintenance faults not addressed by module changes.
7. As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TM 1-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

If overspeed not confirmed by Maintenance Terminal, a cockpit speed indicator fault was probably the cause of the overspeed indication. Proceed as follows to correct.

1. Perform maintenance actions required to clear any faults indicated by Maintenance Terminal.
2. Select Maintenance Terminal Real Time Analog Data display page.
3. Operate engine at light-on-skids power (at 100% Np/Nr).
4. Read and compare Ng and Np indications from cockpit speed indicator and from Maintenance Terminal.

Perform a check run to verify cockpit speed indicators agree with Maintenance Terminal speeds.

Return to service

IF PROBLEM IS Ng:
Replace or repair Multiparameter Display Ng channel (similar to TM 55-1520-248-23, Tasks 8-1-5, 8-1-6, 8-1-7, and 8-1-8).

IF PROBLEM IS Np:
Replace or repair Dual Tachometer Np channel (similar to TM 55-1520-248-23, Tasks 8-1-12, -13, and -14).

6 Oct 1997
Rev. A 16 Feb 1998
R-10. Ng Or Np Speed Not Indicating

Engine rotor speed signals (Ng and Np) are each generated by dual channel sensors located in the engine accessory gearbox. Either channel can supply the control system requirements, and logic within the FADEC allows it to detect and reject a faulty channel, and switch to the other, without functional impairment.

The engine speed indicators in the cockpit share channel No. 2 on each speed sensor with the FADEC. If sensor channel No. 2 fails, there is no capability to use the alternate channel -- the result being loss of cockpit engine speed indication for the engine rotor system involved.

If cockpit speed indication is lost or erratic as a result of sensor failure, it will result in an Ng or Np fault indication on the Maintenance Terminal. If the aircraft wiring or speed indicator is responsible, there will be no Maintenance Terminal fault indication.

To correct the problem, proceed as follows:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If, as the result of a fault indication(s), any of the following were replaced:

- ECU
- Engine Electrical Harness
- Speed Sensor on channel experiencing cockpit speed indication problem
  perform a start and determine whether the cockpit speed indication problem still exists.

CONTINUED FROM -- BELOW --

Np:
Frequency -- 9500 to 10500 Hz
Desired Cockpit Speed Indicator (in %) = Freq. x .0097879

Ng:
Frequency -- 17000 to 18000 Hz
Desired Cockpit Speed Indicator (in %) = Freq. x .0056022

Did cockpit indicator read correctly?

- Disconnect engine electrical harness connector J6 (Np) or P7 (Ng), as applicable.
- Connect a frequency generator [TBD] across engine electrical harness connector J6 sockets D and E (Np) or connector P7 pins TBD and TBD (Ng).
- Perform following with aircraft powered up IAW (Similar to TM 55-1520-248-23, Task 9-3-10).
- Feed a frequency (in range noted below) into the specified pins/sockets of the engine electrical harness connector. Note frequency and resulting reading on cockpit speed indicator:

-- CONTINUED --

ABOVE

Connector damaged?

- Replace component with damaged connector (speed sensor, engine electrical harness, or both)

7 Oct 1997
Rev. A 5 Feb 1998

EDR 19982
R-10. Ng Or Np Speed Not Indicating

Perform a start and determine whether the cockpit speed indication problem is corrected.

Speed indication OK?

No

R-10 AA (Pg 2)

Yes

Return to service

CONTINUED FROM -- BELOW --

Np:
Frequency -- 9500 to 10500 Hz
Desired Cockpit Speed Indication (in %) = Freq. x .0097879

Ng:
Frequency -- 17000 to 18000 Hz
Desired Cockpit Speed Indication (in %) = Freq. x .0056022

Did cockpit indicator read correctly?

Yes

R-10 BB (Pg 3)

No

Troubleshoot aircraft wiring from connector P2 (at ECU) to the cockpit speed indicators, IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).

Wiring problems detected and corrected?

No

Perform a start and verify that the cockpit speed indication problem is corrected.

Yes

Return to service

IF PROBLEM IS Ng:
Replace or repair Multiparameter Display Ng channel IAW (Similar to TM 55-1520-248-23, Tasks 8-1-5, 8-1-6, 8-1-7, and 8-1-8).

IF PROBLEM IS Np:
Replace or repair Dual Tachometer Np channel IAW (Similar to TM 55-1520-248-23, Tasks 8-1-12, -13, and -14).

Perform a start and verify that the cockpit speed indication problem is corrected.

Return to service

-- CONTINUED --

ABOVE
R-10. Ng Or Np Speed Not Indicating

R-10 BB

Reconnect aircraft connector P2 to ECU.

Has ECU been replaced during this sequence?

Yes

Disconnect interface harness connector J3 from engine electrical harness connector P3.
Connect a frequency generator (TBD) across interface connector J3 sockets e and d (Np) or sockets S and T (Ng).
Power up aircraft IAW (Similar to TM 55-1520-248-23, Task 9-3-10).
Feed a frequency (in range noted below) into the specified sockets of the ECU connector. Note frequency and resulting reading on cockpit speed indicator:

Np:
Frequency -- 9500 to 10500 Hz Desired Cockpit Speed Indication (in %) = Freq. x 0.0097879

Ng:
Frequency -- 17000 to 18000 Hz Desired Cockpit Speed Indication (in %) = Freq. x 0.0058022

R-10 AAA (Pg 3)

No

Remove and replace ECU IAW (Similar to TM 55-1520-248-23, Tasks [do not exist -- should be similar to 9-7-2 and 9-7-3 but written to address ECU]).

Perform a start and verify that the cockpit speed indication problem is corrected.

Return to service

R-10 AAA

Did cockpit indicator read correctly?

Yes

Troubleshoot aircraft interface harness from connector P1 (at ECU end) to connector J3 (at the engine electrical harness end), IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).

Perform a start and verify that the cockpit speed indication problem is corrected.

Return to service

No

Reconnect interface harness connector P1 to ECU.

7 Oct 1997
Rev. A 5 Feb 1998
R-10. Ng Or Np Speed Not Indicating

- Remove and replace Engine Electrical Harness IAWTMI-2840-263-23, 73-21-00, para 2A. and 2B.
- Perform a start and verify that the cockpit speed indication problem is corrected.
- Return to service

7 Oct 1997
Rev. A 5 Feb 1998
R-11. Oil Consumption High (Exceeding One Quart Per Five Hours Engine Operation)

Engine oil consumption is normally quite low. An oil usage rate in excess of one quart in five hours is indicative of a problem and requires corrective action.

Primary sources of oil consumption are:
- **External**, from such places as lube system tubes and fittings, oil tank, oil cooler, scavenge oil filter, and accessory gearbox output shaft and accessory drive lip seals. External oil leaks can be detected visually and most can be repaired without engine removal.
- **Gas path**, from locations such as the front compressor carbon seal, the power turbine No. 5 labyrinth seal, or the accessory gearbox breather vent. These leaks are generally detectable from oil puddling or wetting of adjacent surfaces.
- **Internal**, into various internal cooling air or pressure balance cavities, resulting from labyrinth seal wear or rubbing, coking and blockage of oil scavenge passages, or degradation of oil scavenge pump capacity. These conditions, the most hazardous to engine health, can usually be detected by continuous smoking from the engine exhaust.

If oil consumption exceeds one quart in five hours, or has increased suddenly, visually inspect the engine, lube system, and drains.

Oil from three sources can leak into the exhaust collector flow path and result in excessive oil consumption:
- The compressor diffuser vent enters the exhaust collector on the left forward side. Excessive oil wetness indicates improperly sized orifice.
- The gearbox breather vents into the exhaust collector on the right forward side. Excessive oil wetness indicates a leaking breather gearshaft lip seal or extremely high gearbox internal breather pressure.
- Buffer air from the no. 5 labyrinth seal vents into the exhaust collector. Excessive labyrinth clearance or inadequate buffer air pressure result in oil leaking into the inner hub fairing and forming puddles in the bottom of the exhaust collector. Inspect the exhaust collector flow path and determine whether any of these conditions exist.

Locate source(s) of leakage and correct as follows:
- **TUBE ENDS, HOSE ENDS, FITTINGS, ETC.** -- tighten as required
- **EXTERNAL LUBE SYSTEM COMPONENTS** -- repair or replace IAW (Similar to TM 55-1520-248-23):
  - Oil tank -- Tasks 4-4-1 through 4-4-8
  - Oil cooler bypass valve -- Task 4-4-9
  - Oil scavenge filter -- Task 4-4-18
- **ENGINE ACCESSORY DRIVE LIP SEALS** -- replace IAW TMI-2840-263-23, 72-60-00, para 1.B. Associated accessory remove/reinstall tasks:
  - HMU -- TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.
  - PMA -- [no tasks written yet]
- **STARTER-GENERATOR** -- (Similar to TM 55-1520-248-23, Task 9-3-15)
- **OUTPUT DRIVE LIP SEALS** -- (Similar to TM 55-1520-248-23, Task 4-1-9)

Perform check run to verify leakage corrected

Return to service
R-11. Oil Consumption High (Exceeding One Quart Per Five Hours Engine Operation)

R-11 A
- Examine diffuser vent orifice (Ref. TMI-2840-263-23, 72-00-00, 1.B.), Diffuser Vent Orifice Selection to verify orifice properly seated and not blocking feed port to no. 5 labyrinth seal. If it is blocking feed port, reseat properly so as not to block.
- Check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, 1.B., Diffuser Vent Orifice Selection.

Make check run to verify diffuser vent oil leakage eliminated.

Return to service

R-11 B
- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A. (This also requires removal of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.)
- Remove and replace Breather gear shaft lip seal per TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall compressor and turbine modules per TMI-2840-263-23, 72-30-00, para 1.B. and 72-50-00, 1.B.
- Reinstall engine IAW TM 55-1520-248-23, Task 4-1-2.*

Return to service

R-11 C
- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace Turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, 1.B., Diffuser Vent Orifice Selection.

Return to service

8 Oct 1997
Rev. A 16 Feb 1998
R-11. Oil Consumption High (Exceeding One Quart Per Five Hours Engine Operation)

- Remove air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
- Inspect inlet of compressor for oil wetting on impeller.
- Inspect forward end of impeller for radial looseness.

Oil wetting or impeller looseness noted?

- No
  - Service power turbine support oil supply and scavenge details IAW following tasks of TM 55-2840-263-23, 72-50-00, para 5.F.
  - Remove power turbine pressure oil fitting, screen, and nozzle.
  - Service power turbine pressure oil fitting, screen, and nozzle.
  - Install power turbine pressure oil fitting, screen, and nozzle.
  - Service power turbine scavenge oil strut.
  - Remove and service scavenge oil sump.
  - Measure oil flow from power turbine scavenge oil strut.
  - Install scavenge oil sump.
  - Measure engine oil system scavenge oil flow.

- Yes
  - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
  - Remove and replace Accessories gearbox module IAW TM 55-2840-263-23, 72-50-00, para 1.A., respectively (this requires removal and reinstallation of compressor and turbine modules).
  - Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Scav oil flow measurement test OK?

- No
  - Perform check run to verify satisfactory oil consumption.

- Yes
  - Is oil consumption satisfactory?

  - No
    - Return to service
  - Yes
    - Return to service

Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace Compressor module IAW TM 2840-263-23, 72-30-00, para 1.A. and 1.B. (This also requires removal and reinstallation of turbine module IAW TM 2840-263-23, 72-50-00, para 1.A. and 1.B.)
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TM 2840-263-23, 72-00-00, 1.B., Diffuser Vent Orifice Selection.

Return to service

8 Oct 1997
Rev. A 16 Feb 1998

EDR 18682
Lip-type oil seals are used for the engine output drives, engine component and accessory drives, and the accessory gearbox breather gearshaft.

If leakage from any of these seals is high enough to influence engine oil consumption rate or to oil down the engine compartment, the offending seal(s) may be replaced without removing the engine from the aircraft (except for the accessory gearbox breather gear seal).

The lip seals used in the engine are listed below. The gear train (Ng or Np) associated with each seal is also shown.

Np -- Output drive -- front
Np -- Output drive -- rear
Ng -- Starter-generator drive
Ng -- Tachometer drive
Np -- Tachometer drive
Ng -- Spare drive -- front
Np -- Spare drive -- rear
Ng -- HMU drive
Np -- PMA drive
Ng -- AGB breather gear

If a leaking seal requires replacement, proceed as follows:

Return to service
R-12. Oil Leaking From Accessory Gearbox Drive(s)

R-12 A
Leakage of these seals is usually detected by an increase in aircraft transmission oil level, as visual indications of leakage are obscured by the presence of the freewheeling unit.

Remove and replace leaking output drive seal(s) IAW (Similar to TM 55-1520-248-23, Task 4-1-9). This requires execution of the following tasks as well:

- Forward fairing removal/installation (2-1-21)
- Air induction cowl removal/installation (4-2-1, 4-2-3)
- Engine-to-transmission driveshaft removal/installation (6-2-2)
- Forward tail rotor assembly shaft removal/installation (6-6-1)
- Freewheeling unit removal/installation (6-5-1, 6-5-7)
- Freewheeling unit forward housing assembly removal/installation (6-5-1, 6-5-7)
- Freewheeling unit aft bearing and seal cap removal/installation (6-5-1, 6-5-7)
- AC generator assembly removal/installation (9-4-8, 9-4-9)

After seal installation, perform check run to verify leakage corrected.

R-12 B
- Remove engine IAW TM (Similar to 55-1520-248-23, Task 4-1-1).
- Remove compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A. (This also requires removal of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.)
- Remove and replace Breather gear shaft lip seal per TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall compressor and turbine modules per TMI-2840-263-23, 72-30-00, para 1.B., and 72-50-00, para 1.B.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

After seal installation, perform check run to verify leakage corrected.

R-12 C
- Remove starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15).
- Remove and replace Starter-generator drive lip seal IAW TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall starter-generator IAW (Similar to TM 55-1520-248-23, Task 9-3-15) using a new O-ring on the drive shaft at the base of the spline.

8 Oct 1997
Rev. A 16 Feb 1998

R-12 D
- Remove HMU IAW TMI-2840-263-23, 73-21-01, para 1.A.
- Remove and replace HMU drive lip seal IAW TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall HMU per TMI-2840-263-23, 73-21-01, para 1.B. using new O-ring on drive shaft at base of spline. Task includes rigging check (Para 1.D.), fuel system purge (Para 1.B.), and maintenance check flight.

Prior to flight check, perform ground check run to verify seal leakage corrected.

R-12 DD
- Remove unspecified accessory mounted on leaking drive IAW applicable task of (Similar to TM 55-1540-248-33).
- Remove and replace Tach or spare drive lip seal IAW TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall unspecified accessory IAW applicable task of (Similar to TM 55-1540-248-33).

R-12 EE
- Remove PMA IAW TMI-2840-263-23, 73-20-01, para 1.B.
- Remove and replace PMA drive lip seal per TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall PMA per TMI-2840-263-23, 73-20-01, para 2.B.

R-12 FF
- Remove unspecified accessory mounted on leaking drive IAW applicable task of (Similar to TM 55-1540-248-33).
R-13. Oil Pressure Drops Off Severely With Normal Oil Temperature

There are several potential causes for a severe decrease in oil pressure at normal oil temperature. These include:
- Decrease in level of oil in the tank to the point where the oil pump inlet receives aerated oil
- An obstruction in the aircraft oil supply system
- A fault in the oil pressure transducer or cockpit indicator
- Leakage of oil transfer tubes between the oil pump and filter housing due to damaged O-rings, wear of the tube seal lands or bores into which they are inserted, or other internal oil leak
- Sticking of the oil pressure regulator valve or broken regulator spring
- Oil foaming, resulting in reduced oil flow
- Defective oil pump

If a severe drop in Main Oil Pressure (MOP) occurs during operation with normal engine oil temperature, proceed as follows to isolate and correct the problem:

1. Perform a check run and determine whether MOP is satisfactory
2. If MOP is satisfactory:
   - Return to service
3. If MOP is unsatisfactory:
   - Check the engine oil pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-3) as follows:
     - Install pressure gage and tee fitting between sensing line and MOP transducer.
     - Motor engine and bleed air from gage and sense line.
     - Operate engine at 100% Np, warm oil until temperature stabilizes, and read gage and cockpit MOP indicator.

4. If does not show normal MOP:
   - Return to service
5. If gage shows normal MOP:
   - Operate engine at 100% Np, warm oil until temperature stabilizes, and verify satisfactory MOP.

Troubleshoot, remove, repair/replace, and reinstall Main Oil Pressure channel of Multiparameter Display unit, IAW (Similar to TM 55-1520-248-23) Appendix K, Section III, and Tasks 8.1.5 through 8.1.8.
R-13. Oil Pressure Drops Off Severely With Normal Oil Temperature

R-13 A

Remove and inspect oil pressure regulator valve assembly IAW TMI-2840-263-23, 72-60-00, para 2.D. and 3.A. Repair as needed and reinstall per TMI-2840-263-23, 72-60-00, para 1.D.

Operate engine at 100% Np, warm oil until temperature stabilizes, and verify MOP does not drop off significantly as oil warms.

MOP drop significantly as oil warms?

Yes

Adjust oil pressure regulating valve IAW TMI-2840-263-23, 72-60-00, para 3.A.

No

Return to service

R-13 BB

(Pg 3)

R-13 AA

(Pg 3)

Remove oil filter housing and check valve IAW TMI-2840-263-23, 72-60-00, para 1.D.

Remove transfer tubes and inspect O-rings on both ends, as well as check valve O-rings.

Inspect O-ring lands on transfer tubes and check valve for wear.

Inspect bores in filter housing body and accessory gearbox housing (where transfer tubes and check valve are inserted) for wear.

If O-ring land wear is noted on oil transfer tubes, replace Oil transfer tubes

If O-ring land wear is noted on oil check valve, replace Oil check valve

If transfer tube bore wear is noted in oil filter housing, replace Oil filter housing

Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing. This includes the following:

- Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
- Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
- Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
- Clean oil filter housing assembly (TMI-2840-263-23, 72-60-00, para 1.C.).
- Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B.).
- If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing, and flush aircraft oil lines and oil cooler.

R-13 BB

(Pg 3)

R-13 AA

(Pg 3)

Reinstall oil filter housing, transfer tubes, and check valve per Para 1.D., using all new O-rings and gasket.

Operate engine at 100% Np, warm oil until temperature stabilizes, and verify MOP satisfactory.

MOP satisfactory?

Yes

Return to service

No
R-13. Oil Pressure Drops Off Severely With Normal Oil Temperature

R-13 AA

- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17)
- Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1)

Operate engine at 100% Np, warm oil until temperature stabilizes, and verify MOP satisfactory.

MOP satisfactory?

No

R-13 BB

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1)
- Remove and replace Accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A, respectively. (This requires removal and reinstallation of compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.A., 1.B and 72-50-00, para 1.A., 1.B)
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2)

Yes

Return to service

Return to service
R-14. Oil Pressure Fluctuates

The primary causes for oil pressure fluctuation are:

- Low oil tank level to the point where the oil pump inlet is receiving aerated oil
- Inadequate bleeding of oil pressure sensing line
- A fault in the oil pressure transducer or cockpit indicator
- Sticking of the oil pressure regulator valve
- An obstruction in the aircraft oil supply system
- Oil foaming, resulting in non-steady oil flow
- A defective oil pump or other lube system fault within the accessory gearbox

If significant fluctuations of Main Oil Pressure (MOP) occur during steady state engine operation, proceed as follows to isolate and correct the problem:

1. Check oil level in tank and replenish IAW (Similar to TM 55-1520-248-33, Task 1-4-5.1).

2. More than 2 quarts needed to fill?
   - No
   - Yes
   - Perform a check run and determine whether MOP is stable.

3. MOP stable?
   - No
   - Yes
   - Return to Service

4. Bleed Main Oil Pressure transducer line by loosening hose fitting at transducer. Motor engine with starter until solid stream of oil flows from fitting. Tighten fitting while engine is still motoring and oil is still flowing.

5. Perform a check run and determine whether MOP is stable.

6. MOP stable?
   - No
   - Yes
   - Return to Service

7. Check the engine oil pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-3) as follows:
   - Install pressure gage and tee fitting between sensing line and MOP transducer.
   - Motor engine and bleed air from gage and sensing line.

8. Perform a check run and determine whether MOP is stable on cockpit MOP indicator.

9. Does cockpit indicator show stable MOP?
   - No
   - Yes
   - Return to Service

10. Perform a check run and determine whether MOP is stable on pressure gage.

11. Does gage show stable MOP?
    - No
    - Yes

12. Remove pressure gage and tee fitting.
    - Replace aircraft MOP transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4).
    - Motor engine and bleed air from transducer and sensing line.

13. Perform a check run and determine whether MOP is stable on cockpit MOP indicator.

14. Does cockpit indicator show stable MOP?
    - No
    - Yes
    - Return to Service

10 Oct 1997
Rev. A 18 Feb 1998
**R-14. Oil Pressure Fluctuates**

**R-14 A**
- Troubleshoot, remove, repair/replace, and reinstall Main Oil Pressure channel of Multiparameter Display unit, IAW (Similar to TM 55-1520-248-23, Appendix K, Section III, and Tasks 8.1.5 through 8.1.8).

**R-14 B**
- Remove and inspect oil pressure regulator valve assembly IAW TMI-2840-263-23, 72-60-00, para 2.D. and 3.A.
- Repair as needed and reinstall per TMI-2840-263-23, 72-60-00, para 2.F.

**Perform a check run and determine whether MOP is stable.**

**MOP stable?**
- **Yes**
  - Adjust oil pressure regulating valve IAW TMI-2840-263-23, 72-60-00, para 3.A.
  - Return to service

- **No**
  - **Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing. This includes the following:**
    - Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
    - Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
    - Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
    - Clean oil filter housing assembly (TMI-2840-263-23, 72-60-00, para 1.C.).
    - Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B.).
    - If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer TMI-2840-263-2372-00-00, para 8.A., Lubrication System Servicing), and flush aircraft oil lines and oil cooler.

  - Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
  - Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).

  **Perform a check run and determine whether MOP is stable.**

**MOP stable?**
- **Yes** (Pg 3)
  - Return to service
- **No**

**10 Oct 1997**
**Rev. A 18 Feb 1998**
R-14. Oil Pressure Fluctuates

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace Accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A., respectively. (This requires removal and reinstallation of compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.A, 1.B., and 72-50-00, para 1.A, 1.B.)
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Return to service
Main Oil Pressure (MOP) above 130 PSIG, when encountered with a newly installed engine or after parts changes that affect oil flow or MOP regulation, can be handled with an adjustment of the oil pressure regulator. A sudden increase for no obvious reason, however, is cause to suspect other oil system problems, whose diagnosis and correction should not be masked by an oil pressure regulator adjustment.

The most likely causes of high MOP are:
- Measurement error by aircraft MOP transducer or cockpit indicator
- Obstruction of pressure oil passage(s) within the accessory gearbox
- Blockage of oil supply to the turbine module or to one or both turbine oil nozzles

Only the first item can be corrected without engine removal for teardown, inspection, and repair.

If Main Oil Pressure above 130 PSIG is encountered (except immediately after an engine start during cold weather operations), proceed as follows to resolve.

- Start the engine, and while maintaining allowable oil pressure limits as indicated by the gage, warm the oil to normal operating temperature.
- Increase power to light-on-skids condition but not above 130 PSIG.
- Read pressure on gage and on cockpit indicator.

Does gage confirm high MOP?

For R-15 A (Pg 2) to Ensure parts changes affecting MOP just made?

- Remove pressure gage and tee fitting.
- Replace aircraft MOP transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4).
- Motor engine and bleed air from transducer and sensing line.

Perform a check run and determine whether high MOP is still shown by cockpit indicator.

Adjust oil pressure regulating valve IAW TMI-2840-263-23, 72-60-00, para 3.A.

Return to service

Troubleshoot, remove, repair/replace, and reinstall Main Oil Pressure channel of Multiparameter Display unit, IAW (Similar to TM 55-1520-248-23, Appendix K, Section III, and Tasks 8-1-5 through 8-1-8).

Perform a check run and verify satisfactory MOP on cockpit indicator.

Return to service

13 Oct 1997
Rev. A 18 Feb 1998
- Remove and replace engine IAW (Similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).
- Service engine oil system IAW TMI-2840-263-23, 72-00-00,para 8.A., Lubrication System Servicing and (Similar to TM 55-1520-248-23, Task 1-4.5.1).
- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- Flush aircraft oil lines and oil cooler.
Low Main Oil Pressure (below 115 PSIG), when encountered with a newly installed engine or after parts changes that affect oil flow or MOP regulation, can be handled with an adjustment of the oil pressure regulator. A sudden or progressive decrease for no obvious reason, however, is cause to suspect other oil system problems, whose diagnosis and correction should not be masked by an oil pressure regulator adjustment.

The most likely causes of low MOP are:
- Decrease in level of oil in the tank to the point where the oil pump inlet is receiving aerated oil
- External oil leak
- Obstruction in the aircraft oil supply system
- Clogged oil filter
- A fault in the aircraft oil pressure transducer or cockpit indicator
- Sticking oil pressure regulator valve or broken regulator spring
- Leakage of oil transfer tubes between the oil pump and filter housing due to cut O-ring, wear of the tube seal lands or bores into which they engage, or other internal oil leak
- Excessive oil temperature resulting from aircraft oil cooler (or related) fault
- Oil foaming, resulting in reduced oil flow
- A defective oil pump

If Main Oil Pressure is not at least 50 PSIG from Ground Idle to 79% NG, 90 PSIG from 79% to 94% NG and 115 PSIG at speeds above 94% NG, perform the following sequence to isolate and resolve the problem:

- Visually inspect the engine, tube system, and drains for external leakage.
- External oil leakage or drainage noted?
  - Yes
    - Locate source(s) of leakage and correct as follows:
      - TUBE ENDS, HOSE ENDS, FITTINGS, ETC. -- tighten, repair, or replace as required
      - EXTERNAL LUBE SYSTEM COMPONENTS -- repair or replace IAW (Similar to TM 55-1520-248-23:
        Oil tank -- Tasks 4-4-1 through 4-4-8
        Oil cooler bypass valve -- Task 4-4-9
        Oil scavenge filter -- Task 4-4-18
      - Check oil level in tank and replenish IAW (Similar to TM 55-1520-248-33, Task 1-4-5.1).
    - Perform check run to verify satisfactory MOP (very brief if MOP below limits).
  - No
    - More than 2 quarts needed to fill?
      - Yes
        - Perform check run to verify satisfactory MOP (very brief if MOP below limits).
      - No
        - MOP satisfactory?
          - Yes
            - Return to service
          - No
            - Check the engine oil pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-3), as follows:
              - Install pressure gage and tee fitting between sensing line and MOP transducer.
              - Motor engine and bleed air from gage and sensing line.
              - Operate engine at 100% Np and read gage and cockpit MOP indicator. If MOP is within limits on gage, continue to operate until oil temperature stabilizes and recheck gage and cockpit indicator.
            - Check oil level in tank and replenish IAW (Similar to TM 55-1520-248-33, Task 1-4-5.1).
            - R-16 B (Pg 2)
            - 14 Oct 1997
            - Rev. A 22 Feb 1998

R-16. Oil Pressure Too Low

Does gage show normal MOP?

- Remove pressure gage and tee fitting.
- Replace aircraft MOP transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4).
- Motor engine and bleed air from transducer and sensing line.
- Operate engine at 100% Np, warm oil until temperature stabilizes, and read cockpit MOP indicator.

MOP on aircraft indicator satisfactory?

- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).
- Operate engine at 100% Np and check MOP. If within limits, warm oil until temperature stabilizes, and verify that MOP remains satisfactory.

Troubleshoot, remove, repair/replace, and reinstall Main Oil Pressure channel of Multiparameter Display unit, IAW (Similar to TM 55-1520-248-23, Appendix K, Section III, and Tasks 8.1.5 through 8.1.8).

Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing. This includes the following:
- Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
- Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
- Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23,72-60-00, para 1.C.).
- Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B.).
- If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer (TMI-2840-263-23, 72-60-00, para 2.D.), and flush aircraft oil lines and oil cooler.

MOP satisfactory?

- Perform a slow engine acceleration from Ground Idle to 100% Np/Nr with rotor at flat pitch condition. Observe whether MOP regulates, i.e., remains essentially constant, above some Ng level, or whether it continues to increase as Ng increases. [Minimize running time with MOP below limits]

Does MOP regulate?

- Remove and inspect oil pressure regulator valve assembly IAW TMI-2840-263-23, 72-60-00, para 3.A. Repair as needed and reinstall per Para 2.D.

R-16 AA (Pg 3)
R-16. Oil Pressure Too Low

**R-16 AA**

Adjust oil pressure regulating valve IAW TMI-2840-263-23-72-60-00, para 3.A.

**Able to adjust MOP within 115-130 PSIG limits?**

- **Yes**
  - Return to service
- **No**
  - If O-ring land wear is noted on oil transfer tubes, replace Oil transfer tubes.
  - If O-ring land wear is noted on oil check valve, replace Oil check valve.
  - If transfer tube bore wear is noted in oil filter housing, replace Oil filter housing.

**Transfer tube bore wear in gearbox housing?**

- **Yes**
  - Reinstall oil filter housing, transfer tubes, and check valve per Para 1.D., using all new O-rings and gasket.
  - Operate engine at 100% Np and check MOP. If within limits, warm oil until temperature stabilizes, and verify that MOP remains satisfactory.
- **No**
  - Low MOP may be caused by high oil temperature.
    - Operate engine at 100% Np with rotor at flat pitch condition, and determine if MOP remains within limits until oil temperature exceeds 225°F (107°C).
    - If MOP is below limits with oil temperature below 225°F (107°C), abort run without waiting for oil temperature to stabilize, in order to minimize operating time at low MOP.

**MOP satisfactory?**

- **Yes**
  - Return to service
- **No**
  - Low MOP at less than 225°F (107°C) oil temp?
    - **No**
      - **R-16 AAA**
    - **Yes**
      - **R-16 BBB**

**R-16 AAA**

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace Accessory gearbox module IAW TMI-2840-263-23-72-60-00, para 1.A., respectively. (This requires removal and reinstallation of compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.A. and 1.B., 72-50-00, para 1.A. and 1.B.)
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

**R-16 BBB**

- Return to service

14 Oct 1997
Rev. A 22 Feb 1998
R-16. Oil Pressure Too Low

- Check oil cooler blower inlet for obstructions and clear as needed.
- Check oil cooler outlet duct for obstructions and clear as needed.

If no obstructions found, check oil cooler bypass valve:
- Perform oil cooler bypass valve functional check IAW (Similar to TM 55-1520-248-23, Task 4-4-6.1).
  If required, remove, inspect, repair, and reinstall bypass valve per (Tasks 4-4-9 and 4-4-10).

If oil cooler valve bypass valve is satisfactory, check oil cooler temperature control valve:
- Remove, clean, inspect, repair/replace, and reinstall oil temperature control valve IAW (Similar to TM 55-1520-248-23, Tasks 6-8-20 and 6-8-21).

If oil cooler temperature control valve is satisfactory, check oil cooler:
- Remove, clean, inspect, repair/replace, build up, and reinstall oil cooler IAW (Similar to TM 55-1520-248-23, Tasks 6-8-22 through 6-8-24).

Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1 and transmission oil system per Task 1-4-6.1).

Operate engine at 100% Np and warm oil until temperature stabilizes. Verify that oil temperature regulates properly and MOP remains satisfactory.

Return to service
Transfer of oil from the aircraft transmission tube system to the engine lube system can occur:
- At the interface between the engine accessory gearbox front output drive and the aircraft free-wheeling unit (FWU)
  and/or
- At the rear accessory gearbox power takeoff, where the aircraft tail rotor drive shaft aft bearing and seal cap is mounted.

The FWU lube circuits are isolated from the engine lube system by lip seals at the engine front and rear output drives, but lip seal leakage or inadequate scavenging of the FWU can allow entry of aircraft oil into the engine lube system.

If the level of oil in the engine tank is observed to be increasing with time during operation while the transmission oil level is decreasing, proceed as follows:

- Inspect oil return line from FWU to transmission for sharp bends, kinks, or obstructions that could inhibit proper scavenging of oil from the FWU, and correct as required.

- Remove AC generator from left rear side of engine (Task 9-4-8) for required clearance.
- Remove FWU IAW (Similar to TM 55-1520-248-23, Task 6-5-1). This requires removal of engine-to-transmission drive shaft (Task 6-2-2) and removal of forward tail rotor shaft (Task 6-6-1).
- Remove and replace front and rear accessory gearbox output drive lip seals IAW TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall AC generator IAW (Similar to TM 55-1520-248-23, Task 9-4-9)
- Reinstall FWU per Task 6-5-7, which includes installation of engine-to-transmission drive shaft (Task 6-2-2) and installation of forward tail rotor shaft (Task 6-6-1)

- Service engine oil system IAW TMI-2840-263-23, 72-60-00, para 8.A., Lubrication System Servicing. This includes the following:
  - Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
  - Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
  - Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
  - Clean oil filter housing assembly TMI-2840-263-23, 72-60-00, para 1.D. and 2.F.
  - Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B.).
  - Flush engine-related aircraft oil lines and oil cooler.
  - If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing.

- Remove and replace scavange oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).

- Ground run engine at 100% Np for at least one hour to verify no transfer of oil between aircraft and engine lube systems.

Return to service
Transfer of oil from the engine lube system to the aircraft transmission lube system can occur:
- At the interface between the engine accessory gearbox front output drive and the aircraft free-wheeling unit (FWU) and/or
- At the rear accessory gearbox power takeoff, where the aircraft tail rotor drive shaft aft bearing and seal cap is mounted

The FWU lube circuits are isolated from the engine lube system by lip seals at the engine front and rear output drives, but lip seal leakage can allow entry of engine oil into the aircraft lube system, particularly when driven by an abnormally high accessory gearbox breather pressure.

If the level of oil in the transmission is observed to be increasing with time during operation while the engine oil tank level is decreasing, proceed as follows:

Inspect the accessory gearbox breather exit port, on the right forward side of the exhaust collector, for excessive oil wetness or puddling. This is indicative of high accessory gearbox internal breather pressure (or of a leaking breather gearshaft lip seal).

Excessive oil wetness around breather exit port?
- Yes
  - Examine diffuser vent orifice TMI-2840-283-23, 72-00-00, para 1B. Diffuser Vent Orifice Selection, to verify orifice properly seated and not blocking feed port to No. 5 labyrinth seal. If it is blocking feed port, reuse properly so as not to block.
  - Check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-283-23, 72-00-00, para 1B., Diffuser Vent Orifice Selection.

- No
  - Oil loss through the accessory gearbox breather vent can be caused by:
    - Excessive compressor seal vent pressure
    - Breather gearshaft lip seal leakage
    - Excessive internal pressure resulting from worn or damaged turbine labyrinth seals
    - Examine diffuser vent orifice TMI-2840-283-23, 72-00-00, para 1B., Diffuser Vent Orifice Selection, to verify orifice properly seated and not blocking feed port to No. 5 labyrinth seal. If it is blocking feed port, reuse properly so as not to block.
    - Check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-283-23, 72-00-00, para 1B., Diffuser Vent Orifice Selection.

Make a check run at 100% Np and determine whether wetness still exists around gearbox breather exit port.

Breather exit port still wet with oil?
- Yes
  - Ground run engine at 100% Np for at least one hour to verify no transfer of oil between aircraft and engine lube systems.
- No
  - Any oil transfer from engine to transmission?
    - Yes
      - Drain transmission oil IAW (Similar to TM 55-1520-248-23, Task 1-4-6).
      - Drain FWU per Task 1-4-6.
      - Remove/clean/replace transmission filters per Tasks 1-4-6, 1-4-6.1, 8-8-3.
      - Refill and service transmission per Task 1-4-6.1.
      - Ground run engine at 100% Np for at least one hour to verify no transfer of oil between aircraft and engine lube systems.
    - No
      - Was it necessary to install larger orifice?
        - Yes
          - Return to service
        - No
          - R-18 A (Pg 2)
R-18. Aircraft Transmission Oil Level Increases During Flight As Engine Oil Tank Empties

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove FWU IAW (TM 55-1520-248-23, Task 6-5-1).
- Remove compressor module IAW TMI-2840-263-3, 72-30-00, para 1.A. (This also requires removal of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.)
- Remove and replace Breather gearshaft lip seal and Front and rear accessory gearbox output drive lip seals IAW TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.B. and 72-50-00, para 1.B.
- Reinstall FWU IAW (Similar to TM 55-1520-248-23, Task 6-5-7)
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Ground run engine at 100% Np for at least one hour to verify no transfer of oil between aircraft and engine lube systems.

Any oil transfer from engine to transmission?

- Yes
  - Return to service

- No
  - Excessive oil wetness around breather exit port?
    - Yes
      - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
      - Remove and replace Turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. adn 1.B.
      - Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
      - As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.
    - Return to service

- No
  - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1.)
  - Remove and replace Accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A. respectively (this requires removal and reinstalltion of compressor and turbine modules IAW 72-30-00, para 1.A., 1.B. and 72-50-00, para 1.A.,1.B.)
  - Reinstall engine IAW TM 55-1520-248-23, Task 4-1-2'

Ground run engine at 100% Np for at least one hour to verify no transfer of oil between aircraft and engine lube systems.

- Drain transmission oil IAW (Similar to TM 55-1520-248-23, Task 1-4-6).
- Drain FWU per Task 1-4-6.
- Remove/clean/replace transmission filters per Tasks 1-4-6, 1-4-6.1, 6-8-3.
- Refill and service transmission per Task 1-4-6.1.

Return to service

15 Oct 1997
Rev. A 24 Feb 1998

EDR 18882
R-18. Aircraft Transmission Oil Level Increases During Flight As Engine Oil Tank Empties

- Remove FWU IAW (Similar to TM 55-1520-248-23, Task 6-5-1). This requires removal of engine-to-transmission drive shaft (Task 6-2-2) and removal of forward tail rotor shaft (Task 6-6-1).
- Remove AC generator from left rear side of engine (Task 9-4-8) for required clearance.
- Remove and replace Front and rear accessory gearbox output drive lip seals IAW TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall AC generator IAW (Similar to TM 55-1520-248-23, Task 9-4-9).
- Reinstall FWU per Task 6-5-7, which includes installation of engine-to-transmission drive shaft (Task 6-2-2) and installation of forward tail rotor shaft (Task 6-6-1).

Ground run engine at 100% Np for at least one hour to verify no transfer of oil between aircraft and engine lube systems.

- Drain transmission oil IAW (Similar to TM 55-1520-248-23, Task 1-4-6).
- Drain FWU per Task 1-4-6.
- Remove/clean/replace transmission filters per Tasks 1-4-6, 1-4-6.1, 6-8-3.
- Refill and service transmission per Task 1-4-6.1.

Return to service

Any oil transfer from engine to transmission?
Yes

No
The compressor diffuser vent system, which provides buffering pressure to the compressor impeller rear inner labyrinth seal and the turbine No. 5 labyrinth seal, consists of a 2-piece tube, flanged on both ends with slip joint between, and gaskets at the flanges. At the forward end, the tube connects to a mating flange on the compressor diffuser, and, at the aft end, to another flange on the turbine exhaust collector. A size-selected orifice, which controls vent system pressure, is located at the exhaust collector end.

If the vent pressure is too low, oil can leak past either or both of the labyrinth seals, the compressor seal into the vent tube and thence into the exhaust collector, and the No. 5 seal into the exhaust collector hub fairing. If the pressure is too high, it increases internal breather pressure in the accessory gearbox, which raises oil consumption by increasing oil blown overboard through the AGB breather vent.

If oil spewing or seeping from the diffuser vent orifice or tubing joints is encountered, the vent pressure must be adjusted by orifice resizing.

Proceed as follows:

- Remove vent tube (both sections), IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.
- Examine diffuser vent orifice to verify orifice properly seated and not blocking feed port to No. 5 labyrinth seal. If it is blocking feed port, reseat properly so as not to block.
- Check flatness of vent tube flange faces. Replace either or both if bent or distorted.
- Reassemble with new gaskets.

- Check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Ground run the engine and verify pressure is at least 0.8 in. Hg at Ground Idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Return to service
The accessory gearbox overboard vent system is comprised of a breather gear that centrifugally separates oil droplets from air within the gearbox, before venting the air overboard through the gear hub. The vent air passes through an internal passage in the gearbox housing to an elbow fitting atop the gearbox. From there, it passes through a tube with an O-ring sealed slip joint to a flanged fitting on the front of the turbine exhaust collector (right side), where it passes overboard into the engine exhaust stream. The only potential site for external seeping is the flange at the exhaust collector, which is sealed with a gasket. The slip joint has no leakage potential as long as the O-ring is intact. Spewing into the exhaust stream can result from leakage of the lip seal on the centrifugal breather gearshaft, which bypasses the gear and does not benefit from the separating action. Another source is excessive air leakage into the gearbox, from too high compressor seal vent pressure or from worn or damaged turbine seals in cooling air or pressure balance circuits.

If oil spewing or seeping from the accessory gearbox breather vent or tubing joints is encountered, proceed as follows:

- Check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Ground run the engine and verify pressure is at least 0.8 in. Hg at Ground Idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.
R-20. Oil Spewing Or Seeping From Gearbox Vent And Tubing Joints

Correct external seepage of vent tube as follows (Ref. Similar to TM 55-2840-256-23, Task 5-1-3, steps 23 through 27):

- If the slip joint is the site of the seepage, replace the O-ring.
- If the seepage is at the flange, check flange face flatness with a straight-edge. If bent or distorted, replace the flanged tube. Use a new gasket when reassembling.

Make a ground check run to verify seepage is corrected.

Return to service

R-20 B

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A. (This also requires removal of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.)
- Remove and replace breather gearshaft lip seal IAW TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.B. and 72-50-00, para 1.B.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

During ground running following reinstallation of engine, determine whether spewing still occurs.

Does it still spew from breather vent?

- Yes
  - Any external seepage from breather vent tube?
    - Yes
      - Return to service
    - No
      - Return to service
  - No
    - Return to service

- No
  - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
  - Remove and replace turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A and 1.B.
  - Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
  - As part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Return to service

16 Oct 1997
R-21. Oil Temperature Exceeds 107°C (225°F)

Engine main oil temperature (MOT) -- the temperature of oil supplied to the engine from the oil tank -- is limited to 107°C (225°F) on a continuous basis. It may exceed that temperature, up to as high as 120°C (248°F) for not more than 10 minutes, if the engine is inspected afterward. If the oil temperature exceeds 120°C (248°F) for any period of time, however brief, the engine must be removed from the aircraft and sent to a maintenance/overhaul facility for inspection and repair.

Causes of high MOT indication are usually either:
- Erroneous MOT measurement, involving the cockpit indicator, the oil temperature transducer, or the interconnecting wiring or
- Problems in the aircraft oil cooling system (cooler, cooler temperature control valve, cooler fan, or cooler bypass valve).

If indicated oil temperature exceeded 107°C (225°F), proceed as follows:

Check calibration of MOT measurement system as follows:
- Drain oil tank IAW (Similar to TM 55-1520-248-23, Task 1-4-5).
- Remove oil temperature transducer from oil tank per Task 4-4-6.
- With oil temperature transducer connected electrically and aircraft powered up per Task 9-3-10, place transducer in container of boiling water. Allow to stabilize at a gentle boil and read cockpit MOT indication on Multiparameter Display unit (MPD). Compare reading with temperature of boiling water at the prevailing barometric pressure.

MPD within 5°F (2.8°C) of boiling water temp?
  - Yes
    - R-21 B (Pg 2)
  - No

Obtain another known good oil temperature transducer and repeat calibration check in boiling water.

MPD within 5°F (2.8°C) of boiling water temp?
  - Yes
    - R-21 A (Pg 2)
  - No

Troubleshoot, remove, repair/replace, and reinstall Main Oil Temperature channel of Multiparameter Display unit or related aircraft wiring, IAW (Similar to TM 55-1520-248-23, Appendix K, Section III, and Tasks 8.1.5 through 8.1.6.).

During boiling water checks, was MPD reading too high?
  - Yes
    - High enough to disprove oil overtemperature?
      - Yes
        - R-21 B (Pg 2)
      - No
        - MPD read about the same with both temp transducers?
          - Yes
            - Reinstall the original oil temperature transducer in the oil tank IAW (Similar to TM 55-1520-248-23, Task 4-4-6. Service oil tank per 1-4-5.1).
          - No
            - Reinstall the second oil temperature transducer in the oil tank IAW (Similar to TM 55-1520-248-23, Task 4-4-6. Service oil tank per 1-4-5.1).
  - No
    - Return to service

16 Oct 1997
Rev. A 26 Feb 1998
R-21. Oil Temperature Exceeds 107°C (225°F)

Did original transducer read higher on MPD?

Yes

High enough to disprove oil overtemperature?

Yes

Based on logic to this point, it is likely an oil overtemperature occurred, and appropriate action must be taken, as follows:

Correct oil cooling system problem per the following sequence:

- Check oil cooler blower inlet for obstructions and clear as needed.
- Check oil cooler outlet duct for obstructions and clear as needed.

If no obstructions found, check oil cooler bypass valve:

- Perform oil cooler bypass valve functional check IAW (Similar to TM 55-1520-248-23, Task 4-4-8.1). If required, remove, inspect, repair, and reinstall bypass valve per Tasks 4-4-9 and 4-4-10.

If oil cooler valve bypass valve is satisfactory, check oil cooler temperature control valve:

- Remove, clean, inspect, repair/replace, and reinstall oil temperature control valve IAW (Similar to TM 55-1520-248-23, Tasks 6-8-20 and 6-8-21).

If oil cooler temperature control valve is satisfactory, check oil cooler:

- Remove, clean, inspect, repair/replace, build up, and reinstall oil cooler IAW (Similar to TM 55-1520-248-23, Tasks 6-8-22 through 6-8-24).

The answers to the following questions, based on pilot observations, establish actions required with respect to the engine.

Did observed oil temperature exceed 120°C (248°F)?

Yes

Did oil temp exceed 107°C (225°F) for over 10 minutes?

Yes

Reinstall the second oil temperature transducer in the oil tank IAW (Similar to TM 55-1520-248-23, Task 4-4-6. Service oil tank per 1-4-5.1.).

Return to service

Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 6.A., Lubrication System Servicing. This includes the following:

- Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
- Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
- Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
- Clean oil filter housing assembly (TMI-2840-263-23, 72-60-00, para 1.D.).
- Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B.).
- If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer (TMI-2840-263-23, 72-60-00, para 4.B.).
R-21. Oil Temperature Exceeds 107°C (225°F)

R-21 AA

- If carbon particles found in oil filter, service power turbine pressure oil fitting, screen and nozzle IAW TMI-2840-263-23, 72-50-00, para 5.F. service power turbine scavenge strut, and measure oil flow from power turbine scavenge oil strut.
- If main oil pressure is below limits as a result of oil overtemperature incident, remove and replace Oil filter housing assembly per TMI-2840-263-23, 72-60-00, para 1.D.
- Tag removed oil filter housing assembly with reason for removal.

- If not already done as part of cooling system troubleshooting, flush out aircraft oil lines and oil cooler.
- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17)
- Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).

If oil pressure regulator housing was replaced, adjust main oil pressure regulator valve IAW TMI-2840-263-23, 72-60-00, para 3.A.

R-21 BB

- Ground run engine for 10 minutes at light-on-skids power.
- Reinspect and clean the oil filter IAW TMI-2840-263-23, 72-60-00, para 1.C.
- Inspect and clean the magnetic chip detectors per Para 4.B.
- If carbon particles found in oil filter, service power turbine pressure oil fitting, screen, and nozzle IAW TMI-2840-263-23, 72-50-00, para 5.F. service power turbine scavenge strut per and measure oil flow from power turbine scavenge oil strut per.
- After five hours of operation, reinspect the oil filter and magnetic chip detectors.
- If carbon particles found in oil filter, service power turbine pressure oil fitting, screen and nozzle IAW TMI-2840-263-23, 72-50-00, para 5.F. service power turbine scavenge strut per, and measure oil flow from power turbine scavenge oil strut per.

- Remove and Replace engine IAW (Similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).
- Tag removed engine with information indicating that oil temperature limit was exceeded, and list maximum oil temperature reached and elapsed time limit exceeded.
- Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing.
- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- If not already done as part of cooling system troubleshooting, flush out aircraft oil lines and oil cooler.

Return to service

EDR 18882

16 Oct 1987
Rev. 12 Jul 99

Page B-95
The low power/high MGT condition can result from many factors, among which are:
- Inlet obstruction
- Compressor inducer bleed restriction or detachment
- Dirty compressor
- Damaged compressor
- Instrumentation errors in MGT or Torque measurement
- Anti-icing air leak
- Cabin heater air leak
- Compressor air leak
- External air leak
- Turbine internal leak
- Turbine damage
- Combustor distortion, cracking, burning

If MGT has shifted high on the Power Assurance Check trend line use the sequence below to diagnose and correct.

Inspect inducer bleed duct for security of attachment at both ends and freedom from restriction (Similar to Ref. TM 55-1520-248-23, Task 2-1-24).

Was bleed duct detached or restricted?
- Yes
  - R-22 AA
  - R-22 A (Pg 2)
- No
  - Test anti-icing system IAW TMI-2840-263-23, 75-01-00, para 4.A. and 4.B.

Was anti-icing system function OK?
- No
  - R-22 BB
  - R-22 B (Pg 2)
- Yes
  - Isolate cabin heater by disconnecting aircraft bleed air tube at cabin heater mixing valve inlet and plugging end of tube.
  - Perform power assurance check.

Expected performance level restored?
- Yes
  - R-22 C (Pg 2)
  - Remove the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
    - Inspect the compressor inlet for blockage or obstruction.
    - Inspect the inlet particle separator panels and tubes for damage or blockage.
    - Inspect compressor for damage to inlet guide vanes or impeller vanes, or rub or erosion of shroud lining in vicinity of impeller vane tips.
- No
  - R-22 D (Pg 2)
  - Reinstall air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-3).
    - Detergent spray, hand wash, and water rinse compressor rotor IAW TMI-2840-263-23, 72-30-00, para 4.A. and 4.B.
  - Perform power assurance check.

Expected performance level restored?
- Yes
  - Return to service
- No
  - R-22 E (Pg 3)
R-22. Power Low With High MGT

R-22 A
Correct inducer bleed duct and attachment or restriction condition as required.

Perform power assurance check.

Expected performance level restored?

R-22 AA (Pg 1)
Yes
Return to service

No

R-22 C
Repair or replace aircraft heater mixing valve IAW (Similar to TM 55-1520-248-23, Tasks 13-1-1, 13-1-2, 13-1-3, 13-1-4, & 13-1-5, as applicable.) Remove plug and reconnect aircraft bleed air tube to mixing valve inlet.

Perform power assurance check.

Return to service

R-22 D
- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace compressor module IAW TMI-2804-263-23, 72-30-00, para 1.A. and 1.B. (This also requires removal and reinstallion of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B.)
- Identify replaced compressor module as having been subjected to inlet blockage and send to overhaul.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
- As a part of the check runs accompanies engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at take-off power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.b., Diffuser Vent Orifice Selection.

Return to service

20 Oct 1997
Rev. A 5 Mar 1998
Field-check the calibration of the cockpit MGT indicator as follows:

- Remove the two nuts from the MGT harness terminal block studs and lift off MGT harness leads and engine electrical harness leads (but leave signal leads from engine accessory harness attached to the studs).
- Using Thermocouple Calibrator (OMEGA Model CL-300-1000C-K [TBD] or equivalent), attach the chromel lead of the calibrator to the chromel terminal block stud and the alumel calibrator lead to the alumel terminal block stud.
- Reinstall the stud nuts, and torque to 18-24 in.-lb.
- Power up the aircraft with battery or APU.
- Set thermocouple calibrator to 800°C (1472°F) and observe and record MGT value displayed on the cockpit MGT indicator.
- Repeat above steps at calibrator settings of 700°C (1292°F) and 600°C (1112°F).
- MGT indications from cockpit digital MGT indicator should agree with the thermocouple calibrator within ± TBD °C (± TBD °F).

Troubleshoot and repair aircraft wiring from engine accessory harness interface connector J16, pins L (alumel), M (chromel), and K (shield), to cockpit MGT indicator, IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).

- Check torque indication as follows:
  - Connect Maintenance Terminal (MT) and select Real Time Data display.
  - Operate engine at light-on-skids power and simultaneously observe torque as indicated by MT and by cockpit torque indicator.

Problems detected and corrected?

- Replace cockpit MGT indicator IAW (Similar to TM 55-1520-248-23, Task 8-1-9).

- Remove calibrator and reconnect MGT harness leads to terminal block, along with engine electrical and accessory harness MGT leads, and torque stud nuts to 18-24 in.-lb.

- Perform power assurance check.

Cockpit MGT indicator agrees with calibrator?

- Return to service

Do cockpit and MT torque values agree?

- Operate engine at Ground Idle. Loosen fittings at torquemeter pressure transducers for FADEC and cockpit, and bleed lines until solid oil flows, then tighten.
- Recheck agreement between MT and cockpit indicator at Light-On-Skids power.

- Do cockpit and MT torque values agree?

20 Oct 1997
R-22. Power Low With High MGT

- Remove and replace aircraft engine torque transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4)
- Recheck agreement between MT and cockpit indicator at Light-On-Skis power.

Do cockpit and MT torque values agree?

- Troubleshoot, remove, repair/replace, and reinstall cockpit torque indicator or related aircraft wiring, IAW (Similar to TM 55-1520-248-23, Appendix K, Section III, and Tasks 8.1.9 through 8.1.11).
- Recheck agreement between MT and cockpit indicator at Light-On-Skis power.

Look for external engine air leaks as follows:
Start engine and operate at ground idle. Inspect for air leakage in the following areas and, if located, make repairs IAW the referenced tasks in TMI-2840-263-23, 72-30-00:

- COMPRESSOR SCROLL -- include flanges for aircraft bleed air off-take and unused bleed air off-take. Leakage from cracks in scroll, or from scroll-to-shroud or scroll-to-rear diffuser flanges are cause for compressor module replacement, which requires engine removal and reinstallation. Inspect - Repair allowable leaks - Para 3.D., and (Similar to TM 55-1520-248-23, Task 4-1-5.) Remove engine/replace compressor module/ reinstall engine - Tasks 3-1-1, 3-2-2, 5-1-2, & 5-1-3, and (Similar to TM 55-1520-248-23, Tasks 4-1-1 & 4-1-2)


Were leaks detected and corrected?

- Install first stage nozzle shield (replace existing part if condition requires).
- If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B., (or replace).
- If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. (or replace).
- Install combustion module IAW TMI-2840-263-23, 72-40-00, para 1.B. and 2.A.

Return to service

Perform power assurance check

R-22
AAA

R-22
BBB

20 Oct 1997
R-22. Power Low With High MGT

- Remove engine IAW (Similar to TM55-1520-248-23, Task 4-1-1).
- Remove and replace turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B.
- If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.b. (or replace).
- If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. (or replace).
- Install combustion module IAW TMI-2840-263-23, 72-40-00, para 1.B. and 2.A.
- Reinstall engine IAW (Similar to TM55-1520-248-23, Task 4-1-2).

Were combustion module parts changes/repairs made?

- No
  - Perform power assurance check.
  - Expected performance level restored?
    - No
      - Return to service
    - Yes
      - Return to service
  - Yes
    - Return to service

- Yes
  - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
  - Remove and replace compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A. and 1.B. (This also requires removal and reinstallation of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B.)
  - Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
  - As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gauge attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Perform power assurance check.

Return to service

20 Oct 1997
R-23. Power Low With MGT Below Maximum Limit

The inability to reach high power conditions, with correspondingly low MGT, is probably caused by one of the following:

- Misriggering of the linkage from the throttle twist grip to the HMU power lever, preventing travel to the maximum stop on the HMU
- A travel restriction in the aircraft rotor system that limits collective pitch application.
- Low engine fuel inlet pressure, resulting in inadequate fuel supply
- A fault in the ECU or HMU

If unable to reach high power, with a correspondingly low MGT, proceed as follows to correct condition:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If, as a result, any relevant parts were replaced or procedures performed, operate the engine at high power and determine whether the problem is corrected.

Able to reach high power satisfactorily?

- No
  - Return to service

- Yes
  - Inspect fuel control rigging IAW TMI-2840-263-23, 73-21-01, para 1.D.
  - If required, re-rig throttle linkage IAW (Similar to TM 55-1520-248-23, Task 4-6-1).

Rerigging required?

- No
  - Operate the engine at high power and verify that the problem is corrected.
  - Return to service

- Yes
  - Check Multifunction display memory for Fuel Filter Bypass caution.
  - Check engine fuel filter pop-out for extension.

Fuel filter in bypass or impending bypass mode?

- No
  - Operate the engine at high power and verify that the problem is corrected.
  - Return to service

- Yes
  - Remove and replace engine fuel filter element IAW TMI-2840-263-23, 73-10-01, para 2.A. and 2.B.
  - Purge fuel system per TMI-2840-263-23, 73-00-00, para 1.B.
  - Operate the engine at high power and verify that the problem is corrected.
  - Return to service

21 Oct 1997
R-23. Power Low With MGT Below Maximum Limit

Was HMU changed earlier in this procedure?

Yes

Remove and Replace ECU IAW (Similar to TM 55-1520-248-23, Tasks 9-7-2 and 9-7-3).

No

Remove and Replace HMU IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.

Operate the engine at high power and verify that the problem is corrected.

Able to reach high power satisfactorily?

No

Operate the engine at high power and verify that the problem is corrected.

Yes

Return to service

Return to service
Loss of the FADEC droop anticipation feature results in greater than normal Np/Nr droop and a slight delay in the onset of acceleration during collective pulls. A position potentiometer in the collective pitch linkage is the source of the droop anticipation signal. If misrouted or failed, delayed accelerations and increased Np/Nr droop will occur and the control system will declare a FADEC DEGRADE Advisory on the MFD. A failure within the ECU can also produce these same symptoms.

Connect the Maintenance Terminal and query the Display Faults (Static) page for Current and Last Run faults. A CPFIT should be listed (possibly along with other faults resulting from the primary CP position fault), or a fault related to an ECU failure.

- Troubleshoot the collective pitch signal fault problem by replacing the potentiometer and/or repairing faulty aircraft wiring, IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).
- If collective pitch potentiometer is replaced, rig per (Similar to TM 55-1520-248-23, Task 11-2-1, steps 18 through 26).

Clear any other maintenance faults indicated by the Maintenance Terminal.

Perform a check flight to verify satisfactory accelerations and Np/Nr droop.

Return to service
Continuous plumes or prolonged (several second) bursts of white (oil) smoke from the engine exhaust are probably the result of one or more of the below listed faults:

- Exhaust collector drain blocked
- Leaking No. 1 carbon seal
- Failed No. 1 bearing
- Blocked power turbine scavenger strut
- Defective turbine seals
- Leaking No. 5 labyrinth seal
- Restricted scavenger flow from turbine
- Restricted scavenger flow in aircraft system
- Leaking oil transfer tubes or check valve
- Faulty oil pump

In the absence of evidence suggesting a specific cause, proceed as follows to identify and resolve the problem.

Inspect the turbine exhaust collector for wetness, oil puddling, and drain blockage.

![Diagram of decision tree for smoking during steady state operation]

- Remove the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
- Inspect the compressor inlet for oil wetting of impeller or on inside of shroud.
- Inspect the inlet for looseness of impeller at No. 1 bearing area, for damage to inlet guide vanes or impeller vanes, or for rub or erosion of shroud lining in vicinity of impeller vane tips.

Looseness, oil wetting, or rub noted?

- Yes

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

- No

Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing. This includes the following:

- Drain oil tank (Similar to TM 55-1520-248-23, Task 4-1-5).
- Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
- Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
- Clean oil filter housing assembly (TMI-280-263-23, 72-60-00, para 1.D. and 2.F.).
- Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B).
- If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer (TMI-2840-263-23, 72-00-00, para 8.A. Lubrication System Servicing), and flush aircraft oil lines and oil cooler.
- Remove and replace scavenger oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- Service engine oil system IAW (TM 55-1520-248-23, Task 4-4-5.1).

As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-toturbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove, and replace orifice with another size, IAW TMI-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

27 Oct 1997

EDR 18882
R-25. Smoking During Steady State Operation

To assure necessary pressurization for No. 5 labyrinth seal, verify that compressor seal vent orifice is properly seated. If not seated, seal it.

Was seal seated?

Yes

No

Puddling from No. 5 labyrinth seal?

Yes

No

Wetness from compressor seal vent?

Yes

No

This leaves only the accessory gearbox breather vent as the source of oil wetting.

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove compressor module IAW TMI-2840-263-23, 72-50-00, para 1.A.) (This also requires removal of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.)
- Remove and replace Breather gearbox lip seal per TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall compressor and turbine modules per TMI-2840-263-23, 72-30-00, para 1.B. and 72-50-00, para 1.B.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Make engine run to measure and adjust diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at take-off power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Smoking eliminated?

Yes

No

Return to service

Make check run to determine whether smoking eliminated

Return to service

Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).


Return to service

27 Oct 1997
Rev. 12 July 99

EDR 18882

Page B-105
R-25. Smoking During Steady State Operation

Service power turbine support oil supply and scavenge details IAW following tasks of TMI-2840-263-23, 72-50-00, para 5.F.
- Remove power turbine pressure oil fitting, screen, and nozzle.
- Install power turbine pressure oil fitting, screen, and nozzle.
- Remove and service scavenge oil strut.
- Measure oil flow from power turbine scavenge oil strut.
- Install scavenge oil sump.
- Measure engine oil system scavenge oil flow.

Inspect scavenge return components in aircraft system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, etc.) for possible restrictions, dents, or kinks, and correct as applicable. Also check oil tank vent line. Replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).

Make check run to determine whether smoking eliminated.

Smoking eliminated?

Yes

Return to service

No

Return to service

- If O-ring land wear is noted on oil transfer tubes, replace oil transfer tubes.
- If O-ring land wear is noted on oil check valve, replace oil check valve.
- If transfer tube bore wear is noted in oil filter housing, replace oil filter housing.

Transfer tube bore wear in gearbox housing?

Yes

Transfer tube bore wear in gearbox housing?

No

Were O-rings OK, all other related parts OK?

Yes

Reinstall oil filter housing, transfer tubes, and check valve IAW TM 55-2840-263-23, Task 6-2-4*, using all new O-rings and gasket.

Make check run to verify smoking eliminated.

- If oil filter housing was replaced, measure and adjust main oil pressure IAW TMI-2840-263-23, 72-60-00, para 3.A.

Return to service

27 Oct 1997
R-25. Smoking During Steady State Operation

1. Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
3. Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Measure and adjust main oil pressure IAW TM 55-2840-256-23, Tasks 1-8-12 and 6-2-9.

Return to service
R-26. Smoking During Transients

During deceleration, a brief puff of smoke is not abnormal, but a prolonged plume existing for most or all of the deceleration is cause for corrective action. Among the causes of smoking on deceleration are:

- Exhaust collector drain blocked
- Blocked power turbine scavenge strut
- Defective turbine seals
- Leaking No. 5 labyrinth seal
- Restricted scavenge flow from turbine
- Restricted scavenge flow in aircraft system
- Leaking oil transfer tubes or check valve
- Faulty oil pump

In the absence of evidence suggesting a specific cause, proceed as follows to identify and resolve the problem.

Inspect the turbine exhaust collector for wetness, oil pudding, and drain blockage.

- Oil in exhaust collector?
  - Yes → Return to service
  - No → Exh. coll. drain or tubing obstructed?
    - No → R-26 A (Pg 2)
    - Yes → Correct obstruction and make check run to verify smoking eliminated

Service power turbine support oil supply and scavenge details IAW following tasks of TMI-2840-263-23, 72-50-00, para 5.F.

- Remove power turbine pressure oil fitting, screen, and nozzle.
- Service power turbine pressure oil fitting, screen, and nozzle.
- Install power turbine pressure oil fitting, screen, and nozzle.
- Service power turbine scavenge oil strut.
- Remove and service scavenge oil sump.
- Measure oil flow from power turbine scavenge oil strut.
- Install scavenge oil sump.
- Measure engine oil system scavenge oil flow.

- Oil system scavenge flow check OK?
  - Yes → Return to service
  - No → Make check run to determine whether smoking eliminated.

Smoking eliminated?

- Yes → R-26 B (Pg 2)
- No → Inspect scavenge return components in aircraft system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, etc.) for possible restrictions, dents, or kinks, and correct as applicable. Also check oil tank vent line. Replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).

- Make check run to determine whether smoking eliminated.

Smoking eliminated?

- Yes → Return to service
- No → R-26 C (Pg 3)
R-26. Smoking During Transients

Visually determine whether oil is in the form of a puddle from exhaust collector hub fairing (No. 5 labyrinth seal), or wetness from the compressor rear seal vent (forward left side of exh. coll.) or accessory gearbox breather vent (forward right side of exh. coll.).

Was seal seated?

Yes

To assure necessary pressurization for No. 5 labyrinth seal, verify that compressor seal vent orifice is properly seated. If not seated, seat it.

Make engine run to measure and adjust diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

No

Puddling from No. 5 labyrinth seal?

Yes

Wetness from compressor seal vent?

No

This leaves only the accessory gearbox breather vent as the source of oil wetting.

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A. (This also requires removal of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.).
- Remove and replace Breather gearshaft lip seal per TMI-2840-263-23, 72-60-00, para 1.B.
- Reinstall compressor and turbine modules per TMI-2840-263-23, para 1.B. and 72-50-00, para 1.B.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Smoking eliminated?

No

Make check run to determine whether smoking eliminated.

Yes

Return to service

Return to service

R-25

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Install combustion module IAW TMI-2840-263-23, 72-40-00, para 1.A. and 2.A.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
R-26. Smoking During Transients

**R-26 C**

- Remove oil filter housing and check valve IAW TMI-2840-263-23, 72-60-00, para 1.D.
- Remove transfer tubes and inspect O-rings on both ends, as well as check valve O-rings.
- Inspect O-ring lands on transfer tubes and check valve for wear.
- Inspect bores in filter housing body and accessory gearbox housing (where transfer tubes and check valve are inserted) for wear.

- If O-ring land wear is noted on oil transfer tubes, replace Oil transfer tubes
  - If O-ring land wear is noted on oil check valve, replace Oil check valve
  - If transfer tube bore wear is noted in oil filter housing, replace Oil filter housing

- Transfer tube bore wear in gearbox housing?

---

**Were O-rings OK, all other related parts OK?**

- Yes
  - Reinstall oil filter housing, transfer tubes, and check valve IAW TMI-2840-263-23, 72-60-00, para 3.A. using all new O-rings and gasket.
  - Make check run to verify smoking eliminated.
  - If oil filter housing was replaced, measure and adjust main oil pressure IAW TMI-2840-263-23, 72-60-00, para 3.A.
  - Return to service

- No

---

**Remove engine IAW**
(Similar to TM 55-1520-248-23, Task 4-1-1).

- Remove and replace Accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A. respectively (This requires removal and reinstallation of compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.A, 1.B and 72-50-00, para 1.A, 1.B.)
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

- Measure and adjust main oil pressure IAW TMI-2840-263-23, 72-60-00, para 3.A.

- Return to service

---

27 Oct 1997

EDR 18882
R-27. Faulty Torquemeter Indication

Faulty engine torquemeter indication can be of several kinds -- for example:
an erroneous cockpit instrumentation indication; a problem with FADEC
torque measurement; or a faulty engine pressure signal to both the cockpit
system and the FADEC. A FADEC-related torque problem will probably
result in a FADEC Degrade Advisory

and subsequent MAINTENANCE
FAULT messages accessible through
the MFD or the Maintenance Terminal.
Problems with the cockpit indication
system usually rely on the pilot for
recognition.

Causes of faulty torquemeter indication
include the following:

- Aircraft or FADEC torquemeter
  pressure transducer fault
- Aircraft torque indicator fault
- Aircraft wiring fault between
  transducer and indicator
- Engine harness or interface harness
  between transducer and ECU
- Obstruction in tubing between engine
  and aircraft or FADEC torquemeter
  pressure transducer
- Low engine main oil pressure
- Faulty engine torquemeter
- ECU

If torque indication problems are
encountered, connect the Maintenance
Terminal (MT) and determine whether
FADEC faults are indicated. If so,
perform maintenance actions to clear.
If, as a result of a fault indication(s),
any of the following were replaced,
perform an engine check run and
determine whether the torquemeter
indication problem still exists:

- ECU
- Engine Electrical Harness
- Engine Interface Harness
- Engine Torquemeter Pressure
  Transducer

---

Any of listed parts replaced?

- Torquemeter indication OK now?
  - Yes
  - No

- Is engine main oil pressure below
  limits?
  - Yes
  - No

- Troubleshoot IAW fault correction
  procedure R-16 (Oil Pressure Too Low).
  - When corrected, operate engine and
    recheck torquemeter indication.

- Torquemeter indication OK now?
  - Yes
  - No

- Return to service

---

Any torque related maint codes still
displayed?

- Yes
- No

- Do cockpit and MT torque indications
  agree?
  - Yes
  - No

- Operate the engine at
  ground idle and observe indicated
torque.

- Is indicated torque
  abnormally high?
  - Yes
  - No

- Remove engine IAW
  (Similar to TM 55-
  1520-248-23, Task 4-
  1-1).

- Remove and replace
  Accessory gearbox
  module
  IAW TMI-2840-263-23,
  72-60-00, para 1.A.)
  respectively (This
  requires removal and
  reinstallation of
  compressor and
turbine modules IAW
  TMI-2840-263-23, 72-
  30-00,para 1.A, 1.B.
  and 72-60-00).

- Reinstall engine IAW
  (Similar to TM 55-
  1520-248-23, Task 4-
  1-2).

---

3 Nov 1997
R-27. Faulty Torquemeter Indication

R-27

Measure and adjust main oil pressure IAW TMI-2840-263-23, 72-60-00, para 3.A.

Return to service

R-27

• Operate engine at ground idle. Loosen fittings at torquemeter pressure transducers for FADEC and cockpit, and bleed lines until solid oil flows, then tighten.
• Recheck agreement between MT and cockpit indicator at light-on-skids power.

Do cockpit and MT torque indications agree?

Yes

Return to service

No

• Replace the aircraft torquemeter pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4).
• Operate engine at ground idle. Loosen fittings at torquemeter pressure transducers for FADEC and cockpit, and bleed lines until solid oil flows, then tighten.
• Recheck agreement between MT and cockpit indicator at light-on-skids power.

Do cockpit and MT torque indications agree?

Yes

Return to service

No

• Troubleshoot aircraft wiring to cockpit torque indicator IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).
• If problem not located in wiring, replace cockpit torque indicator IAW (Similar to TM 55-1520-248-23, Task 8-1-9).
• Recheck agreement between MT and cockpit indicator at light-on-skids power.

Do cockpit and MT torque indications agree?

Yes

Return to service

No

3 Nov 1997
R-27. Faulty Torquemeter Indication

**R-27 AA**
- Troubleshoot and repair or replace engine electrical harness IAW TMI-2840-263-23, 73-21-00, para 2.A. and 2.B.
- If required, troubleshoot and repair engine interface harness IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).
- Recheck agreement between MT and cockpit indicator at light-on-skids power.

**R-27 C**
- Operate engine at ground idle. Loosen fittings at torquemeter pressure transducers for FADEC and cockpit, and bleed lines until solid oil flows, then tighten.
- Recheck agreement between MT and cockpit indicator at light-on-skids power.

- **Do cockpit and MT torque indications agree?**
  - **No**
    - **Return to service**
  - **Yes**
    - **Return to service**

- **Replace FADEC torquemeter pressure transducer.**
- Recheck agreement between MT and cockpit indicator at light-on-skids power.

- **Do cockpit and MT torque indications agree?**
  - **No**
    - **Return to service**
  - **Yes**
    - **Return to service**

- **Troubleshoot and repair or replace engine electrical harness IAW TMI-2840-263-23, 73-21-00, para 2.A. and 2.B.**
- If required, troubleshoot and repair engine interface harness IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).
- Recheck agreement between MT and cockpit indicator at light-on-skids power.

- **Do cockpit and MT torque indications agree?**
  - **No**
    - **Return to service**
  - **Yes**
    - **Return to service**

- **Any torque related maint codes still displayed?**
  - **No**
    - **R-27 AAA (Pg 4)**
  - **Yes**
    - **Remove and Replace ECU IAW (Similar to TM 55-1520-248-23, Tasks 9-7-2 and 9-7-3).**
    - **Operate the engine at light-on-skids power and verify that the problem is corrected.**

3 Nov 1997
R-27. Faulty Torquemeter Indication

**R-27 AAA**
- Replace the aircraft torquemeter pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4).
- Operate engine at ground idle. Loosen fittings at torquemeter pressure transducers for FADEC and cockpit, and bleed lines until solid oil flows, then tighten.
- Recheck agreement between MT and cockpit indicator at light-on-skids power.

**R-27 D**
- Operate engine at ground idle. Loosen fittings at torquemeter pressure transducers for FADEC and cockpit, and bleed lines until solid oil flows, then tighten.
- Recheck agreement between MT and cockpit indicator at light-on-skids power.

**Any torque related maint codes still displayed?**
- Yes
  - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
  - Remove and replace Accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A. respectively. (This requires removal and reinstallation of compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.A., 1.B., and 72-50-00, para 1.A., 1.B.)
  - Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
- No
  - Measure and adjust main oil pressure IAW TM 55-2840-256-23, Tasks 1-6-12 and 6-2-9.

**Do cockpit and MT torque indications agree?**
- Yes
  - Return to service
- No
  - Troubleshoot aircraft wiring to cockpit torque indicator IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).
    - If problem not located in wiring, replace cockpit torque indicator IAW (Similar to TM 55-1520-248-23, Task 8-1-9).
    - Recheck agreement between MT and cockpit indicator at light-on-skids power.
    - Return to service
Engine instability in the Power
Turbine Governing mode of
operation (throttle angle at or
above 92°, Np at 95% to 105%)
may be caused by:

- Loose throttle linkage
- Faulty collective pitch position
  potentiometer or linkage
- Np/Nr beeper switch
- Restricted fuel supply
- Engine harness, interface
  harness or aircraft harness to
  ECU
- ECU fault
- HMU fault

This condition may generate a
FADEC Fail Warning or FADEC
DEGRADE Advisory on the MFD
and produce related
MAINTENANCE FAULT
messages on the Maintenance
Terminal (MT). When
encountered, connect the
Maintenance Terminal and read
out Current and Last Run faults.
Perform necessary maintenance
to clear faults, then proceed as
follows:

Did throttle
linkage require
correction?

No

Perform a check run at
light-on-skids power
(or at flight conditions
where instability
previously
encountered) and
observe stability.

No

Perform a check run at
Light-On-Skids power
(or at flight conditions
where instability
previously
encountered) and
observe stability.

Yes

Collective
pitch pot require
correction?

Yes

No

No

Operation
satisfactory?

Yes

Return to service

Check Np/Nr beeper
switch and related
wiring for proper
operation and freedom
from noise or
intermittent operation
IAW (Similar to TM 55-
1520-248-23,
Appendix K, Section
IV), and repair as
required.

Beep switch
or wiring require
correction?

No

Operation
satisfactory?

Yes

Return to service

Check collective pitch
potentiometer and
related wiring, as well
as rigging of linkage,
IAW (Similar to TM 55-
1520-248-23, Task
11-2-1, steps 18 through
26.)

Yes

No

R-28
(Pg 2)

R-28
A
(Pg 2)

3 Nov 1997

EDR 18882
R-28. Unstable In Power Turbine Governing (95% - 105% Np)

R-28 A
Perform a check run at light-on-skids power (or at flight conditions where instability previously encountered) and observe stability.

Operation satisfactory?

No

Return to service

Yes

R-28 B

- Check Multifunction display memory for Fuel Filter Bypass caution.
- Check engine fuel filter pop-out for extension.

Fuel filter in bypass or impending bypass mode?

No

Yes

- Remove and replace engine fuel filter element IAW TMI-2840-263-23, 73-10-01, para 2.A. and 2.B.
- Purge fuel system per Para 1.B.

Perform a check run at light-on-skids power (or at flight conditions where instability previously encountered) and verify stability.

Operation satisfactory?

No

Yes

Return to service

Verify function of aircraft fuel boost pump and freedom from restriction of aircraft fuel supply system, as follows:

- Disconnect aircraft fuel supply hose at HMU fuel inlet port.
- Direct hose into a bucket or similar container.
- Be sure aircraft fuel shutoff valve fully open (lever fully forward).
- Turn Fuel Boost switch on forward overhead console ON. This engages fuel boost pump.
- Verify that fuel is flowing into bucket.
- Flow at least 2 gallons of fuel and then turn Fuel Boost switch OFF and verify fuel flow ceases.
- Remove and replace engine fuel filter element IAW TMI-2840-263-23, 73-10-01, para 2.A. and 2.B.
- Reconnect HMU fuel inlet line and purge engine fuel system IAW Para 1.B.

Perform a check run at light-on-skids power (or at flight conditions where instability previously encountered) and verify stability.

Operation satisfactory?

No

3 Nov 1997
R-28. Unstable In Power Turbine
Governing (95% - 105% Np)

R-28 AA

Was HMU changed earlier in this procedure?

Yes

Remove and Replace ECU
IAW (Similar to TM 55-1520-248-23, Tasks 9-7-2 and 9-7-3).

Perform a check run at light-on-skids power (or at flight conditions where instability previously encountered) and verify stability.

Return to service

No

Remove and Replace HMU
IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.

Perform a check run at light-on-skids power (or at flight conditions where instability previously encountered) and verify stability.

Operation Satisfactory?

No

Yes

Return to service

3 Nov 1997
R-29. Unstable At Ground Idle

Engine instability at Ground Idle (PLA at 30° to 40°, Ng at 64%) may be caused by:
- Loose throttle linkage
- Restricted fuel supply
- Engine Electrical Harness, Interface Harness or aircraft wiring to ECU
- Intermittant Ng speed pick-up or cockpit Np indicator
- ECU fault
- HMU fault

This condition may generate a FADEC Fail Warning or FADEC DEGRADE Advisory on the MFD and produce related MAINTENANCE FAULT messages on the Maintenance Terminal (MT). When encountered, connect the Maintenance Terminal and read out Current and Last Run faults. Perform necessary maintenance to clear faults, then proceed as follows:

Set MT to the Real Time Data -- Analog Parameters page.
- During unstable operation at ground idle, observe cockpit displays of Ng, Np, Torque, and MGT.
- Also observe MT displays of the same parameters.

Does instability show in parameters other than Ng?

This indicates instability is real.
- Inspect throttle linkage, from twist grip to HMU input spindle, for security and freedom from slack or looseness.
- Verify rigging IAW TMI-2840-283-23, 73-21-01, para 1.D.
- Make corrections as required.

Operation satisfactory?

Perform a check run at ground idle and observe stability.

Did throttle linkage require corrective action?

Fuel filter in bypass or impending bypass mode?
- Check Multifunction display memory for Fuel Filter Bypass caution.
- Check engine fuel filter pop-out for extension.

Return to service

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No
R-29. Unstable At Ground Idle

Lack of response in other parameters indicates instability is an Ng indication problem, not actual instability. Since no Ng-related fault shows on MT, problem must be in cockpit Ng indicator (Multiparameter Display Unit -- MDU) or in aircraft wiring between ECU and MDU.

- Troubleshoot aircraft wiring from connector P2 (at ECU) to the cockpit speed indicator (MDU), IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).

If no problem located:

- Replace or repair Multiparameter Display Unit Ng channel IAW (Similar to TM 55-1520-248-23, Tasks 8-1-5, 8-1-6, 8-1-7, and 8-1-8).

Operate the engine at ground idle and verify that no instability is indicated.

Return to service

Operate the engine at ground idle and determine whether instability has been eliminated.

Operation satisfactory?

Yes

Return to service

No

R-29 C

Verify function of aircraft fuel boost pump and freedom from restriction of aircraft fuel supply system, as follows:

- Disconnect aircraft fuel supply hose at HMU fuel inlet port.
- Direct hose into a bucket or similar container.
- Be sure aircraft fuel shutoff valve fully open (lever fully forward).
- Turn Fuel Boost switch on forward overhead console ON. This engages fuel boost pump.
- Verify that fuel is flowing into bucket.
- Flow at least 2 gallons of fuel and then turn Fuel Boost switch OFF and verify fuel flow ceases.
- Remove and replace engine fuel filter element IAW TM-2840-263-23, 73-10-01, para 2.A. and 2.B.
- Reconnect HMU fuel inlet line and purge engine fuel system IAW Para 1.B.

Operate the engine at ground idle and determine whether instability has been eliminated.

Operation satisfactory?

Yes

Return to service

No

R-29 AA

(Pg 3)
R-29. Unstable At Ground Idle

Was HMU changed earlier in this procedure?

Remove and Replace HMU IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.

Operate the engine at ground idle and determine whether instability has been eliminated.

Operation Satisfactory?

Remove and Replace ECU IAW (Similar to TM 55-1520-248-23, Tasks 9-7-2 and 9-7-3).

Operate the engine at ground idle and verify stability.

Return to service

Return to service
R-30. Excessive Vibration

Engine vibration can occur as the result of many factors, the primary ones of which are listed below:
- Loose engine mounts
- Accessory unbalance
- Engine rotor system unbalance (gas generator or power turbine)
- Gear tooth mesh
- Gear unbalance
- Bearing failure
- Response to aircraft rotor system, or to drive system unbalance or alignment

The presence of vibration is sometimes difficult to detect by touch or sound (depending upon frequency and amplitude) but it makes itself known by unusual wear and fretting of external parts and equipment, loosening of nuts, bolts, fasteners, and fittings, etc.

If the existence of higher than normal vibration is known or suspected, take the following actions.

Check the engine mounts for looseness (accessory gearbox side and bottom mounts and turbine mount), and tighten as required (Similar to Ref. TM 55-1520-248-23, Task 4-7-1).

Were mounts loose?

Yes → Refer to applicable aircraft troubleshooting procedures.

No → Torque mounts and conduct vibration check IAW TM 1-2840-263-23 72-00-00 Para 2A.

Use a vibration analyzer such as a Chadwick-Helmuth Model 192 with Model 7570 High Temperature Accelerometers. Other equipment may also be used.

Does vibration still exist?

No → Return to service

Yes → Conduct vibration check IAW TMI-2840-263-23 72-00-00 Para 2A to verify engine caused vibration.

Is vibration engine caused?

Yes → R30 A pg 2

No → Refer to applicable aircraft troubleshooting procedures.

4 Nov 1997
Rev. 12 Jul 99
**R-30. Excessive Vibration**

- Remove the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
- Inspect compressor inlet for indications of impeller vane damage or looseness in front (No. 1) bearing area.

**Impeller looseness noted?**

- Yes
  - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
  - Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

- No
  - Impeller vane(s) damaged or missing?

**Impeller vane(s) damaged or missing?**

- Yes
  - R-30 C (Pg 5)
  - Service engine oil system IAW TMI-2840-263-23, 72-00-00, para B.A., Lubrication System Servicing. This includes the following:
    - Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
    - Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
    - Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
    - Clean oil filter housing assembly (TMI-2840-263-23, 72-60-00, para 1.D).
    - Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B).
    - If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer (TMI-2840-263-23, 72-00-00, para 8.A. Lubrication System Servicing), and flush aircraft oil lines and oil cooler.
    - Remove and replace scavenging oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
    - Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).

  - R-30 B (Pg 3)
  - As a part of the check runs accompanying engine installation Task 4-1-2*, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at take-off power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

- No
  - R-30 A
R-30. Excessive Vibration

- Remove engine exhaust duct IAW (Similar to TM 55-1520-248-23, Task 4-3-1).
- Inspect power turbine rotor exit for damage or evidence of debris passage.

**Damage or evidence of debris passage?**

- Yes -> Any evidence of debris passage or FOD?
  - Yes -> R-30 BB (Pg. 7)
  - No -> R-30 CC (Pg. 7)
- No -> R-30 AA (Pg. 6)

**Check tightness of compressor module to accessory gearbox mounting nuts IAW TMI-2840-263-23, 72-30-00, para 1.B., Step 10, and retorque as required.**

**Check tightness of turbine module to accessory gearbox mounting nuts IAW TMI-2840-263-23, 72-50-00, para 1.B., and retorque as required.**

- Remove the combustion module IAW TMI-2840-263-23, 72-40-00, para 1.A. and 2.A.
- Inspect outer combustion case and combustion liner IAW TMI-2840-263-23, 72-0-00, para 1.C. and 2.B. respectively.
- Inspect turbine 1st stage nozzle shield, nozzle and wheel IAW TMI-2840-263-23, 72-50-00, para 5.D.

**Reinstall combustion module IAW TMI-2840-263-23, 72-60-00, para 1.B. and 2.A.**

- Remove bottom and side magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
- Inspect magnetic chip detectors.

**Is turbine module serviceable or repairable in situ?**

- Yes -> Reinstall first stage nozzle shield (replace existing part if condition requires) Ref. TMI-2840-263-23, 72-50-00, para 2.B.
  - If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B. (or replace).
  - If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. (or replace).

**Are size and number of chips acceptable?**

- Yes -> Service and reinstall magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
  - Reinstall exhaust duct IAW (Similar to TM 55-1520-248-23, Task 4-3-1).
  - Reinstall air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-3).
- No -> Install vibration pick-ups, in the vertical plane, on the engine compressor, accessory gearbox, and turbine, using pick-up mounting brackets described in TMI-2840-263-23, 72-0-00-00, para 2.A., Vibration Test Procedure.
  - Use a vibration analyzer such as Chadwick-Helmuth Model 192 with Model 7570 high temperature accelerometers. Other equivalent equipment may also be used.

R-30 DD (Pg 4)

4 Nov 1997
Rev. 12 Jul 99

EDR 19882
**R-30. Excessive Vibration**

- Operate the engine at the conditions specified in TMI-2840-263-23, 72-00-00, para 6, Operating Limits, and acquire data to determine: Overall Vibration and Discrete Vibration as a function of frequency at the steady state points and Peak Overall Vibration Levels at the defined transient conditions.

- Examine recordings for limits exceedences (and for significant changes if baseline data exists). At those peak conditions, note associated frequencies and attempt to relate them to known engine and aircraft conditions and characteristics.

- If the characteristic frequency of the high vibration is in the range of the aircraft power train, rotor system, or tail rotor system (all usually at or below 100 Hz), follow applicable aircraft maintenance procedures (Engine remains in service).

- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B. Diffuser Vent Orifice Selection.

- Does this describe actual situation?
  - No
    - Return to service
  - Yes
    - Return to service

- If the high vibration occurs on the compressor and its frequency is gas generator rotational, proceed as follows:
  - Remove engine IAW (Similar to TM55-1520-248-23, Task 4-1-1.)
  - Remove and replace Compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A. and 1.B. (This also requires removal and reinstallation of turbine module IAW TMI-2840-263-23, 72-50-00, 1.A. and 1.B.)
  - Reinstall engine IAW (Similar to TM55-1520-248-23, Task 4-1-2).

4 Nov 1997
R-30. Excessive Vibration

Vibration within limits?

Yes

Return to service

No

R-30 AAA

If the high vibration occurs on the accessory gearbox and frequency is gear rotational or gear tooth mesh, proceed as follows:

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace Accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A., respectively.
  (This requires removal and reinstallation of compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.A.1.B. and 72-50-00, para 1.A., 1.B.)
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Measure and adjust main oil pressure IAW TMI-2840-263-23, 72-00-00, para 5.A., Lubrication System Servicing and 72-60-00, para 3.A.

Return to service

R-30 C

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1.)
- Remove bottom and side magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
- Inspect magnetic chip detectors

Are size and number of chips acceptable?

Yes

Replace engine
IAW (Similar to TM 55-1520-248-23, Task 4-1-2)

No

- Service and reinstall magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
- Remove Compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A.
- Remove turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.
- Remove combustion module IAW TMI-2840-263-23, 72-40-00, para 1.A. and 2.A.
- Inspect for evidence of debris passage from compressor into combustion section and turbine.

Evidence of debris passage noted?

Yes

Replace engine
IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

No

R-30 AAAA

( Pg 6)
R-30. Excessive Vibration

R-30

1. Inspect outer combustion case and combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. and 2.B. respectively.
2. Inspect turbine 1st stage nozzle shield, nozzle and wheel IAW TMI-2840-263-23, 72-50-00, para 5.C. and 5.D.
3. Reinstall first stage nozzle shield (replace existing part if condition requires) Ref. TMI-2840-263-23, 72-50-00, para 2.B.
4. If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B. (or replace).
5. If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. (or replace).

R-30

• Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1)*
• Remove bottom and side magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
• Inspect magnetic chip detectors per Para 4.B.

Are size and number of chips acceptable?

Yes ➔

Replace engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2)

No ➔

Service and reinstall magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
• Remove combustion module IAW TMI-2840-263-23, 72-40-00, para 4.A and 2.A.
• Inspect for evidence of debris passage from compressor into combustion section and turbine.

Evidence of debris passage noted?

No ➔

R-30 5A
(Pg 7)

Yes ➔

Replace engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, para 1.B., Diffuser Vent Orifice Selection.

Return to service
R-30. Excessive Vibration

R-30

- Inspect outer combustion case and combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. and 2.B. respectively.
- If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B., (or replace).
- If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. (or replace).

R-30

- Remove and replace Turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B.
- Reinstall combustion module IAW TMI-2840-263-23, 72-40-00, para 1.B. 2.A.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Return to service

R-30

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1.)
- Remove bottom and side magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
- Inspect magnetic chip detectors per Para 4.B.

Are size and number of chips acceptable?

Yes

Replace engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

No

- Service and reinstall magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
- If required, make repairs to outer combustion case IAW TMI-2840-263-23, 72-40-00, para 2.B. (or replace).
- If required, make repairs to combustion liner IAW TMI-2840-263-23, 72-40-00, para 1.C. (or replace).

- Remove and replace Turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B.
- Reinstall combustion module IAW TMI-2840-263-23, 72-50-00, para 1.B. and 2.A.
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Return to service

Shutdown afterfires, which are indicated by rising MGT after cessation of Ng rotation, are usually the result of fuel leaking past the HMU cut-off valve, or of internal oil leakage in the turbine section of the engine.

If an afterfire is encountered, use the following sequence to isolate and correct the fault.

**Afterfires can cause damage to the gas generator turbine that could result in failure. Follow the sequence as specified.**

- After the fire is extinguished and MGT has cooled below 150°C (302°F) — [do not motor engine to cool] — disconnect the fuel nozzle hose at the fuel nozzle end.
- Move the twist grip to cut-off position and observe whether the HMU throttle lever is hard against the minimum (0°) stop. If not against the stop, do not adjust or rerig at this time.
- Open the aircraft fuel shut-off valve.
- Direct the end of the fuel nozzle hose into a container, and motor the engine with the starter.
- With the twist grip in the cut-off position, observe whether fuel flows from the fuel nozzle hose during motoring.

---

**Diagram:**

1. **Did fuel flow from fuel nozzle hose?**
   - **No:** SD-1 A (Pg 1)
   - **Yes:***

2. **Was HMU throttle lever hard against min. stop?**
   - **No:**
   - **Yes:** Remove and Replace HMU IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.
     - This includes checking rigging per Para 1.D., and purging per Para 1.B.
     - Perform a check run to verify proper operation.
     - Return to service

3. **Purge fuel system IAW TMI-2840-263-23, 73-21-01, para 1.B and verify that fuel flow stops when twist grip is returned to cut-off prior to termination of motoring.

4. Perform a check run and shutdown to verify freedom from afterfire.

5. **Return to service**

---

**Reconnect and secure fuel nozzle hose to fuel nozzle.**

6. **Was burner drain valve stuck in closed position?**
   - **No:**
   - **Yes:**
     - **SD-1 C (Pg 2)**

7. **Service burner drain valve per Para 3.C. (or replace), and reinstall per Para 3.B.**

---

10 Nov 1997
SD-1. Afterfire (Rising MGT After Shutdown)

SD-1

B

Perform a check run and shutdown to verify freedom from afterfire.

Return to service

SD-1

C

Perform troubleshooting sequence of Procedure SD-3 (Smoking During Shutdown).

Return to service
Compressor noise during coastdown, sometimes accompanied by radial looseness of the impeller and evidence of vane tip rub, are indications of compressor bearing failure.

If an unusual noise was heard from the vicinity of the compressor during coastdown, and bearing failure is suspected, proceed as follows:

- Remove bottom and side magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
- Inspect magnetic chip detectors per Para 4.B.

Are size and number of chips acceptable?

- Replace engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

- Service and reinstall magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
- Remove the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
- Inspect compressor inlet for indications of impeller vane tip rub or looseness in front (No. 1) bearing area.

Impeller vane tip rub or rotor looseness noted?

- Yes
  - Service and reinstall magnetic chip detectors IAW TMI-2840-263-23, 72-60-00, para 4.B.
  - Remove the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
  - Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
  - Remove and replace.

Impeller vane tip rub or rotor looseness noted?

- No
  - Reinstall the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-3).
  - Perform an engine check run at 100% Np, with rotor at flat pitch, of sufficient duration to reach stabilized oil temperature.
  - Shut down after a two minute cooldown at ground idle.
  - Listen for compressor bearing noise during coastdown.

Does bearing noise persist?

- Yes
  - Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 8.A.m
  - Lubrication System Servicing. This includes the following:
    - Drain oil tank (Similar to TM 55-1520-248-23, Task 4-1-5).
    - Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
    - Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
    - Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B).
    - Flush No. 1 bearing scavenge oil line.
    - If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer (TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing), and flush aircraft oil lines and oil cooler.
    - Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
    - Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 4-5-1).

- No
  - Return to service

5 Nov 1997
As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Return to service
SD-3. Smoking During Shutdown

During coastdown, a brief puff of smoke is not abnormal, but a continuous plume is cause for corrective action. Among the causes of shutdown smoking are:

- Exhaust collector drain blocked
- Burner drain blocked
- Blocked power turbine scavenge strut
- Defective turbine seals
- Leaking No. 5 labyrinth seal
- Restricted scavenge flow from turbine
- Restricted scavenge flow in aircraft system
- Leaking oil transfer tubes or check valve
- Faulty oil pump

In the absence of evidence suggesting a specific cause, proceed as follows to identify and resolve the problem.

Inspect the turbine exhaust collector for wetness, oil puddling, and drain blockage.

Service power turbine support oil supply and scavenge details IAW following tasks of TMI-2840-263-23, 72-50-00, para 5.F.
- Service power turbine pressure oil fitting, screen, and nozzle
- Installing power turbine pressure oil fitting, screen, and nozzle.
- Service power turbine scavenge oil str.  
- Remove and service scavenge oil sump.
- Measure oil flow from power turbine scavenge oil str.
- Install scavenge oil sump.
- Measure engine oil system scavenge oil flow.

Make check run to verify shutdown smoking eliminated.

Smoking eliminated?

SD-3 B (Pg 2)

No

Yes

Return to service

Inspect scavenge return components in aircraft system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, etc.) for possible restrictions, dents, or kinks, and correct as applicable. Also check oil tank vent line. Replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).

Make check run to verify shutdown smoking eliminated.

Smoking eliminated?

SD-3 C (Pg 3)

No

Yes

Return to service

SD-3 AAA

(Pg 4)

Oil in exhaust collector?

Yes

No

Return to service

Exh. coll. drain or tubing obstructed?

Yes

Correct obstruction and make check run to verify shutdown smoking eliminated.

Oil system scavenge flow check OK?

Yes

No

SD-3 A (Pg 2)

5 Nov 1997
Rev. A 16 Mar 1998

EDR 16882

Page B-132
SD-3. Smoking During Shutdown

SD-3

Visually determine whether oil is in the form of a puddle from exhaust collector hub fairing (No. 5 labyrinth seal), or moisture from the compressor rear seal vent (forward left side of exh. coll.) or accessory gearbox breather vent (forward right side of exh. coll.).

Puddling from No. 5 labyrinth seal?

Was seal seated?

Yes

No

Wetness from compressor seal vent?

Yes

No

Make sure necessary pressurization for No. 5 labyrinth seal, verify that compressor seal vent orifice is properly seated. If not seated, seat it.

Make engine run to measure and adjust diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Smoking eliminated?

Yes

No

Return to service

Make check run to verify shutdown smoking eliminated.

Return to service

SD-3

• Remove engine IAW (Similar to TM55-1520-248-23, Task 4-1-1).
• Remove and replace Turbine module IAW TMI-2840-263-23, 72-00-00, para 1.A. and 1.B.).
• Install combustion module IAW TMI-2840-263-23, 72-40-00, para 1.B.
• Reinstall engine IAW (Similar to TM55-1520-248-23, Task 4-1-2).

Return to service

This leaves only the accessory gearbox breather vent as the source of oil wetting.

• Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
• Remove compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A. (This also requires removal of turbine module IAW TMI-2840-263-23, 72-30-00, para 1.B.)
• Remove and replace Breather gearshaft lip seal per TMI-2840-263-23, 72-60-00, para 1.B.
• Reinstall compressor and turbine modules per TMI-2840-263-23, 72-30-00, para 1.B. and 72-50-00, para 1.B.
• Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

5 Nov 1997
Rev. A 16 Mar 1998
Rev. 12 Jul 99
SD-3. Smoking During Shutdown

- Remove oil filter housing and check valve IAW TMI-2840-263-23, 72-60-00, para 1.D.
- Remove transfer tubes and inspect O-rings on both ends, as well as check valve O-rings.
- Inspect O-ring lands on transfer tubes and check valve for wear.
- Inspect bores in filter housing body and accessory gearbox housing (where transfer tubes and check valve are inserted) for wear.

- If O-ring land wear is noted on oil transfer tubes, replace
  - Oil transfer tubes
    - If O-ring land wear is noted on oil check valve, replace
  - Oil check valve
    - If transfer tube bore wear is noted in oil filter housing, replace
  - Oil filter housing

- Was O-rings OK, all other related parts OK?
  - Yes
    - Reinstall oil filter housing, transfer tubes, and check valve IAW TMI-2840-263-23, 72-60-00, para 1.D., using all new O-rings and gasket.

- Make check run to verify shutdown smoking eliminated.
  - If oil filter housing was replaced, measure and adjust main oil pressure IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing and 72-60-00, para 3.A.

- Return to service

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace Accessory gearbox module
  - IAW TMI-2840-263-23, 72-60-00, para 1.A., respectively. (This requires removal and reinstallation of compressor and turbine modules IAW TMI-2840-263-23, 72-30-00, para 1.A., 1.B. and 72-50-00, para 1.A., 1.B.)
- Reinstall engine IAW TM 55-1520-248-23, Task 4-1-2.*

- Measure and adjust main oil pressure IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System and 72-60-00, para 3.A.

- Return to service

5 Nov 1997
Rev. A 16 Mar 1998
SD-3. Smoking During Shutdown

- Remove burner drain valve IAW TMI-2840-263-23, 72-40-00, para 3.A.

Is oil present at burner drain?

- Replace external check valve in turbine pressure oil supply line on right side of engine just below horizontal heat shield, with direction-of-flow arrow pointed alt.
- Remove oil filter housing, two oil transfer tubes, and internal check valve IAW TMI-2840-263-23, 72-60-00, para 2.D.
- Inspect O-ring lands on transfer tubes for wear.
- Inspect bores in filter housing body and accessory gearbox housing (where transfer tubes and check valve are inserted) for wear.
- Replace check valve

Transfer tube or check valve bore wear in gearbox housing?

- If O-ring land wear is noted on oil transfer tubes, replace Oil transfer tubes
- If transfer tube bore wear is noted in oil filter housing, replace Oil filter housing

Reinstall oil filter housing, transfer tubes, and new check valve IAW TMI-2840-263-23, 72-60-00, para 2.F., using all new O-rings and gasket.

Make check run to verify shutdown smoking eliminated.
- If accessory gearbox or oil filter housing was replaced, measure and adjust main oil pressure IAW TMI-2840-263-23, 72-00-00, para 8.A. Lubrication System Servicing and 72-60-00, para 3.A.

Smoking eliminated?

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace Accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A. and 1.B., respectively. (This requires removal and reinstallation of compressor and turbine modules IAW 72-30-00, para 1.A., 1.B., and 72-50-00, para 1.A., 1.B.)
- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Oil running from burner drain valve?

- Remove engine IAW (Similar to TM55-1520-248-23, Task 4-1-1).
- Install combustion module IAW TMI-2840-263-23, 72-40-00, para 1.b. and 2.A.
- Reinstall engine IAW (Similar to TM55-1520-248-23, Task 4-1-2).

Yes

Return to service

SD-3 BBBB (Pg 5)

SD-3 AAAA (Pg 1)

5 Nov 1997
Rev. A 16 Mar 1998
Rev 12 Jul 99
SD-3. Smoking During Shutdown

SD-3
BBBB

Make check run to verify shutdown smoking eliminated.

Return to service

SD-3
CCCC

Service power turbine support oil supply and scavenge details IAW following tasks of TMI-2840-263-23, 72-50-00, para 5.F.
- Remove power turbine pressure oil fitting, screen, and nozzle.
- Service power turbine pressure oil fitting, screen, and nozzle.
- Install power turbine pressure oil fitting, screen, and nozzle.
- Service power turbine scavenge oil strut.
- Remove and service scavenge oil sump.
- Measure oil flow from power turbine scavenge oil strut.
- Install scavenge oil sump.
- Measure engine oil system scavenge oil flow.

Scavenge oil flow check OK?

Yes

No

• Remove engine IAW TM55-1520-248-23, Task 4-1-1.*
• Remove and replace Turbine module IAW TM55-2840-256-23, Tasks 5-1-2* and 5-1-3*).
• Install combustion module IAW TM55-2840-256-23, Task 4-1-5.
• Reinstall engine IAW TM55-1520-248-23, Task 4-1-2.

Make check run to verify shutdown smoking eliminated.

Return to service

Smoking eliminated?

No

Yes

Was accessory gearbox replaced earlier in sequence?

No

Yes

Replace engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Inspect scavenge return components in aircraft system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, etc.) for possible restrictions, dents, or kinks, and correct as applicable. Also check oil tank vent line. Replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).

Make check run to verify shutdown smoking eliminated.

SD-3 5A
(Pg 8)

5 Nov 1997
Rev. A 16 Mar 1998
SD-3. Smoking During Shutdown

SD-3 5A

- Make check run to verify shutdown smoking eliminated.
- Measure and adjust main oil pressure IAW TMI-2840-263-23, 72-00-00, 8.A., Lubrication System Servicing and 72-60-00, para 3.A.

Return to service
Inability to stop the engine by rotating the twist grip to the cut-off position indicates that the positive fuel cut-off valve in the HMU is not closing. If this occurs, the engine must be stopped by moving the aircraft manual fuel valve to the OFF position.

The usual cause of failure to stop is mechanical slack or binding in the aircraft linkage between the twist grip and the HMU, or misrigging of the HMU throttle lever to the aircraft linkage. The possibility also exists that the fault could be in the HMU.

If the engine cannot be shut down by normal means, proceed as follows:

Check the position of the throttle lever on the HMU with the twist grip in cut-off, to verify that it is against the minimum (0°) mechanical stop.

- Inspect throttle linkage, from twist grip to HMU input spindle, for security and freedom from slack or looseness.
- Verify rigging IAW TMI-2840-263-23, 73-21-01, para 1.D.
- Make corrections as required IAW (Similar to TM 55-1520-248-23, Tasks 4-6-1 through 4-6-8, as applicable).

Purge fuel system IAW TMI-2840-263-23, 73-21-01, para 1.B. and, prior to termination of motoring, verify that fuel flow stops when twist grip is returned to cut-off position.

Perform a check run to confirm proper cut-off operation.

Return to service

Return to service

Remove and Replace HMU IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B. This includes checking rigging per Para 1.D., and purging per Para 1.B.

Perform a check run to verify proper cut-off operation.
Off-1. Filter (Engine Fuel) Impending Bypass Indicator Extended

The engine low pressure fuel filter is mounted horizontally, on the aft side of the accessory gearbox, at the bottom. The impending bypass pop-out indicator is located in the head of the filter assembly, on the bottom.

If the pop-out indicator is extended, proceed as follows, IAW (Similar to TM 55-2840-256-23, Task 7-5-1).

Operate the engine at 100% Np with rotor at flat pitch. Depress pop-out indicator.

Does pop-out indicator remain depressed?

Yes

Return to service

No

Remove and replace Fuel filter element IAW TMI-2840-263-23, 73-10-01, para 2.A. and 2.B.

Locate and remove contamination from helicopter fuel system IAW (Similar to TM 55-1520-248-23, Appendix K, Section VI).

• Remove and replace Fuel filter element IAW TMI-2840-263-23, 73-10-01, para 2.A. and 2.B.
• Remove and replace HMU IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B. (This includes checking rigging per Para 1.D., and purging per Para 1.B.)
• Remove and replace Fuel nozzle IAW TMI-2840-263-23, 73-10-03, para 1.A. and 1.B.

Check pop-out indicator following maintenance check flight to verify indicator not extended.

Return to service

Does pop-out indicator remain depressed?

Yes

Return to service with log book entry to inspect after next flight.

No

Filter element contaminated?

Yes

Reinstall fuel filter element IAW TMI-2840-263-23, 73-10-01, para 2.B.

• Remove and replace Fuel filter impending bypass indicator assembly IAW (Similar to TM 55-2840-256-23, Tasks 7-5-8 and 7-5-9).

No

Return to service

11 Nov 1997
Rev. A 16 Mar 1998

EDR 18982

Page B-139
Off-2. Filter (Main Oil) Impending Bypass Indicator Extended

The impending bypass pop-out indicator for the engine main oil filter is located in the oil filter cap, atop the accessory gearbox.

If the pop-out indicator is extended, proceed as follows, IAW TMI-2840-263-23, 72-60-00, para 1.C.

Operate engine at 100% Np, with rotor at flat pitch, until oil reaches stabilized operating temperature.

Press pop-out indicator in and operate engine throughout range from ground idle to light-on-skids power.

Does pop-out indicator remain depressed?

Yes

Return to service

No

Remove oil filter element (Para 1.C.) and reinspect for indications of oil contamination

Contamination noted?

Yes

Return to service

No

- Remove and replace oil filter impending bypass indicator IAW TMI-2840-263-23, 72-60-00, para 1.D.
- Warm engine at 100% Np, with rotor at flat pitch, until oil reaches stabilized operating temperature.
- Press pop-out indicator in.
- Operate engine throughout range from ground idle to light-on-skids power.

Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 1.D. This includes the following:
- Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
- Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
- Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
- Clean oil filter housing assembly (TMI-2840-263-23, 72-60-00, para 1.C.).
- Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B.).
- If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer (TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing), and flush aircraft oil lines, oil cooler, and oil cooler bypass valve.
- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).

Warm engine at 100% Np, with rotor at flat pitch, until oil reaches stabilized operating temperature.
- Press pop-out indicator in.
- Operate engine throughout range from ground idle to light-on-skids power.
- Verify pop-out indicator remains depressed.

Return to service

11 Nov 1997
Rev. A 16 Mar 1998
Off-3. Oil Tank Level Lowering
With Engine Inoperative

When the oil tank level drops with the engine inoperative, it is usually because of leakage from the tank back to the accessory gearbox through:
- A faulty internal check valve
- Oil transfer tube(s)
- Oil pump flange(s).

Also, inadequate oil scavenging during engine coastdown can result in oil retention in the accessory gearbox at shutdown, which produces a similar effect.

If lowering of the oil tank level with the engine inoperative is observed, proceed as follows to resolve the problem:
- Check oil level to confirm level in tank has lowered since engine shutdown.
- Motor engine with starter for 30 seconds and check oil level immediately after coastdown.

Is proper oil tank level restored?

- Start engine and operate at ground idle until oil temperature stabilizes.
- Shut down and check oil level immediately after Ng rotation ceases.

Is proper oil tank level restored?

- Disconnect engine Oil In and Oil Out lines at accessory gearbox, and plug and cap exposed lines and fittings.
- Remove oil filter element IAW TMI-2840-263-23, 72-60-00, para 1.C.
- Fill oil filter cavity with engine oil.
- Check level of oil in filter cavity after 30-60 minutes.

Has oil level in filter cavity dropped?

- Remove bottom magnetic chip detector IAW TMI-2840-263-23, 72-60-00, para 4.b.
- Capture oil draining from chip detector port and measure quantity.

Is amount drained less than 900 cc?

- Reinstall bottom chip detector per Task 6-3-6.
- Service (top off) oil tank IAW (Similar to TM 55-1520-248, Task 1-4-5.1).

Return to service

- Remove oil filter housing IAW TMI-2840-263-23, 72-60-00, para 1.D.
- Remove and replace Oil check valve and reinstall oil filter housing, per Para 1.D., being sure to replace O-rings on check valve and oil transfer tubes, and gasket on oil filter housing.
- Install oil filter element per Para 1.C.
- Connect Oil In and Oil Out lines to accessory gearbox.
- Install bottom chip detector per Para 4.B.
- Service (top off) oil tank IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).

Return to service

11 Nov 1997
Rev. A 17 Mar 1998
Off-3 Oil Tank Level Lowering
With Engine Inoperative

Off-3 A
- Start engine and operate at ground idle until oil temperature stabilizes.
- Shut down and remove bottom magnetic chip detector IAW TMI-2840-263-23, 72-60-00, para 4.B.
- Capture oil draining from chip detector port and measure quantity.

Is amount drained less than 900 cc?

Yes
- Reinstall bottom chip detector per Para 4.B.
- Service (top off) oil tank IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).
- Measure scavenge oil flow from turbine sumps IAW TMI-2840-263-23, 72-50-00, para 5.G.

No
- Follow steps for Off-3 B.

Off-3 B
- Install oil filter element per Para 1.C.
- Connect Oil In and Oil Out lines to accessory gearbox.

Does oil level in scavenge bottles decrease?

Yes
- Replace engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

No
- Inspect scavenge return components in aircraft system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, etc.) for possible restrictions, dents, or kinks, and correct as applicable. Also check oil tank vent line. Replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-17).

Repeat measurement of scavenge oil flow from turbine sumps IAW TMI-2840-263-23, 72-50-00, para 5.G.

Replace engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Remove equipment associated with scavenge oil flow check and restore normal scavenge piping configuration.

Return to service

11 Nov 1997
Rev. A 17 Mar 1998
Off-3. Oil Tank Level Lowering
With Engine Inoperative

1. Start engine and operate at ground idle until oil temperature stabilizes.
2. Shut down and remove bottom magnetic chip detector IAW TMI-2840-263-23, 72-60-00, para 4.B.
3. Capture oil draining from chip detector port and measure quantity.

Is amount drained less than 900 cc?

- Yes
  - Reinstall bottom chip detector per Para 4.B.
  - Service (top off) oil tank IAW (Similar to TM 55-1520-248, Task 1-4-5.1).
  - Return to service

- No
  - Replace engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).
Off-4. Oil Runs From Burner Drain Valve After Shutdown

- Oil, leaking past a faulty external check valve in the turbine pressure oil supply system during shutdown, can flood and overflow the turbine bearing cavities. The oil can then drain by gravity into the outer combustion case and out the burner drain for a period of time after coooldown (until the bearing cavities have drained themselves dry). A similar condition can occur with a faulty lube system internal check valve, in which case seepage into the hot section and out the burner drain can occur on a continuous basis during the post shutdown period.

- If oil leakage from the burner drain valve after shutdown is encountered, resolve the problem in accordance with the following procedure.

Start engine and run at ground idle until oil temperature stabilizes. Shut down and remove burner drain valve (IAW TMI-2840-263-23, 72-40-00, para 3.A.) just as soon as the engine rotor rotation ceases. Place a container under the burner drain boss to collect oil leaking therefrom. Measure and record the amount of leakage after one hour and after two hours.

- Did most of leakage occur during 1st hour?

  - Yes
  - Remove and replace External check valve in turbine pressure oil supply line on right side of engine just below horizontal heat shield, with direction-of-flow arrow pointed alt.
  - Reinstall burner drain valve IAW TMI-2840-263-23, 72-40-00, para 3.B.
  - Start engine and run at ground idle until oil temperature stabilizes.
  - Shut down and remove burner drain valve (IAW TMI-2840-263-23, 72-40-00, para 3.A.) just as soon as the engine rotor rotation ceases.
  - Observe for oil leakage from the burner drain port.

  - No

    - Oil leakage observed?

      - Yes
      - Reinstall burner drain valve IAW TMI-2840-263-23, 72-40-00, para 3.B.
      - Return to service

      - No

      - Return to service

- Remove oil filter housing IAW TMI-2840-263-23, 72-60-00, para 1.D.
- Remove and replace Internal check valve and reinstall oil filter housing, per Para 1.D., being sure to replace O-rings on check valve and oil transfer tubes, and gasket on oil filter housing.

- Reinstall burner drain valve IAW TMI-2840-263-23, 72-40-00, para 3.B.
- Start engine and run at ground idle until oil temperature stabilizes.
- Shut down and remove burner drain valve (IAW TMI-2840-263-23, 72-40-00, para 3.A.) just as soon as the engine rotor rotation ceases.
- Verify no oil leakage from the burner drain port.

12 Nov 1997
Rev. A 17 Mar 1998
Off-5. Starter Will Not Rotate Engine Immediately After Shutdown

Rotating and stationary members of the turbine cool at different rates following shutdown. This can result in contact or interference at close clearance locations, until temperatures stabilize or equalize. During this period of contact, the starter is sometimes unable to rotate the engine. Additional cooling time usually eliminates the contact and allows normal motoring and operation. In some cases, however, rub or mechanical binding in other components can prevent rotation by the starter and can require module changes or engine replacement to resolve.

If the starter is unable to motor engine immediately after shutdown, proceed as follows:

Allow engine to cool naturally (without motoring) to as close to ambient temperature as practicable, but certainly no hotter than MGT of 150°C (302°F), and attempt a start.

Able to start satisfactorily?

Yes

Return to service

No

Replace compressor module

• Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
• Remove Compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A.
• Inspect compressor rotor for freedom of rotation, and absence of rub or mechanical damage.

Is compressor satisfactory?

No

Yes

Replace turbine module

Reinstall first stage nozzle shield (replace existing part if condition requires) Ref. TMI-2840-263-23, 72-50-00, para 2.B.

Check accessory gearbox power gear train and gas generator gear train for freedom of rotation.

Is accessory gearbox satisfactory?

No

Yes

Replace accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A.

• Remove turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 2.A.
• Check turbine gas generator rotor for freedom of rotation.
• Remove combustion module IAW TMI-2840-263-23, 72-40-00, para 1.A. and 2.A.
• Inspect turbine 1st stage nozzle shield, nozzle and wheel IAW TMI-2840-263-23, 72-50-00, para S.C. and S.D.

Is turbine satisfactory or repairable?

No

Yes

Off-S A (Pg 2)

12 Nov 1997
Rev. A 17 Mar 1998
Off-5. Starter Will Not Rotate Engine Immediately After Shutdown

- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Perform check run to verify proper engine function and demonstrate satisfactory starting.

Return to service
Appendix C

Model 250-C30R/3 FADEC Fault Isolation and Correction Visio Charts

57 Procedures (112 pages)
1. STEPPER MOTOR CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
- SmPh1Fit, SmPhAVFit, SmPhBVFit,
- SmPhCVFit, SmPhDVFit, SmPhIVFit

DESCRIPTION:
The ECU power-up test indicates a problem with the ECU/HMU stepper motor circuit.

POSSIBLE CAUSES:
- Mating connectors on ECU, harnesses or HMU loose or damaged
- ECU failure
- HMU stepper motor failure
- Harness failure

Proceed as follows to resolve:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?
- Yes
- No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?
- Yes
- No

A (PG 2)

AT CONNECTOR IASPI, MEASURE RESISTANCE OF EACH OF 4 STEPPER MOTOR WINDINGS THROUGH THE HARNESS.

SOCKETS LIMITS (Q) NOM (Q)
1 & 5 20-40 30
2 & 5 20-40 30
3 & 5 20-40 30
4 & 5 20-40 30

SOCKET-TO-GROUND: >1 MEGOHM


REINSTALL THE ORIGINAL ECU. REPLACE THE HMU PER TM-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE HMU (PER TM-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

21 AUG 1998
1. STEPPER MOTOR CIRCUIT FAULT

A

AT CONNECTOR 1P2, MEASURE RESISTANCE OF EACH OF 4 STEPPER MOTOR WINDINGS THROUGH THE HARNES.

<table>
<thead>
<tr>
<th>SOCKET</th>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; E</td>
<td>20-40</td>
<td>30</td>
</tr>
<tr>
<td>B &amp; E</td>
<td>20-40</td>
<td>30</td>
</tr>
<tr>
<td>C &amp; E</td>
<td>20-40</td>
<td>30</td>
</tr>
<tr>
<td>D &amp; E</td>
<td>20-40</td>
<td>30</td>
</tr>
</tbody>
</table>

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

No →

AT CONNECTOR J4, MEASURE RESISTANCE OF EACH OF 4 STEPPER MOTOR WINDINGS IN THE HMU.

<table>
<thead>
<tr>
<th>PINS</th>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; T</td>
<td>20-40</td>
<td>30</td>
</tr>
<tr>
<td>B &amp; T</td>
<td>20-40</td>
<td>30</td>
</tr>
<tr>
<td>C &amp; T</td>
<td>20-40</td>
<td>30</td>
</tr>
<tr>
<td>D &amp; T</td>
<td>20-40</td>
<td>30</td>
</tr>
</tbody>
</table>

PIN-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

No → REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PERFORM MANUAL/AUTO RESET OF FADEC
- WAIT ABOUT 10 SECONDS AND TWIST GRIP TO GND IDLE POSITION
- USING MAINTENANCE TERMINAL WITH CURRENT FAULTS DISPLAY SELECTED, VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED

PERFORM ANY OTHER RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
2. HOT START ABORT SOLENOID CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
SISFII, SISFIIT

DESCRIPTION:
The ECU indicates a problem with the ECU/HMU HOT START ABORT SOLENOID CIRCUIT

POSSIBLE CAUSES:
- Mating connectors on ECU, harnesses or HMU loose or damaged
- Harness failure
- HMU HSA solenoid failure
- ECU failure

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

DOES FAULT STILL EXIST?

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

HAS HMU ALREADY BEEN REPLACED?

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.
SOCKETS LIMITS (Ω) NOM (Ω)
11 & 10 60 - 150 100
SOCKET-TO-GROUND: >1 MEGOHM

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D


REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

B (PG 2)

A (PG 2)

21 AUG 1998
2. HOT START ABORT SOLENOID CIRCUIT FAULT

A

AT CONNECTOR 1P2, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.

<table>
<thead>
<tr>
<th>SOCKETS</th>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>60 - 150</td>
<td>100</td>
</tr>
</tbody>
</table>

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

No → AT CONNECTOR J4, MEASURE RESISTANCE OF THE SOLENOID WINDING IN THE HMU.

<table>
<thead>
<tr>
<th>PINS</th>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R &amp; S</td>
<td>60 - 150</td>
<td>100</td>
</tr>
</tbody>
</table>

PIN-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

No → REPLACE THE HMU PER TM1-2840-263-235, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, AND VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- START THE ENGINE AND OPERATE AT GROUND IDLE IN BOTH THE AUTO AND MANUAL MODES.
- VERIFY PROPER ENGINE OPERATION.
- PERFORM OVERSPEED SYSTEM TEST AND VERIFY THAT THE ENGINE SHUTS DOWN PROPERLY.

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PART CHANGES ACCOMPLISHED.

RETURN TO SERVICE

21 AUG 1998
3. AUTO/MANUAL CHANGEOVER SOLENOID CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
AMIFII, AMSolII!

DESCRIPTION:
The ECU indicates a problem with the ECU/ HMU auto/manual changeover solenoid circuit.

POSSIBLE CAUSES:
- Mating connectors on ECU, harnesses or HMU loose or damaged
- Harness failure
- HMU auto/manual changeover solenoid failure
- ECU failure

Proceed as follows to resolve:

1. Depower aircraft (similar to TM 55-1520-248-23, task 9-3-11)
2. Before disconnecting any connector, first check for looseness as possible cause of fault.

3. If connector is tight:
   - Is connector tight?
     - Yes: Tighten the connector, ensuring proper keying between the mating plug and receptacle.
     - No: Proceed with the following steps.

4. Measure resistance of the solenoid winding through the harness:
   - At connector 1A6P1, measure resistance of the solenoid winding through the harness.
   - Sockets limits (Ω):
     - Sockets: 6 & 7
     - Nomination (Ω):
       - 9-19: 13
   - Socket-to-ground: >1 Megohm

5. Are resistance measurements within limits?
   - Yes: Continue with the following steps.
   - No: Replace the ECU per the aircraft MM and TM1-2840-263-23, section 73-21-00, para. 4.A through 4.C.

6. After disconnecting any connector, immediately examine pins and sockets:
   - Are pins or sockets bent, recessed or missing?
     - Yes: Replace whichever of the following are applicable:
       - The FADEC interface harness (per the aircraft MM)
       - The electric system harness (per TM1-2840-263-23, section 73-25-01, para. 4.A through 4.C)
       - The ECU (per TM1-2840-263-23, section 73-21-01, para. 1.A through 1.D)
     - No: Proceed with the following steps.

7. Does fault still exist?
   - Yes: Perform intermittent fault procedure (task 33).
   - No: Has ECU already been replaced?

8. Replace the ECU per the aircraft MM and TM1-2840-263-23, section 73-21-00, para. 4.A through 4.C.

9. Reinstall the original ECU. Replace the HMU per TM1-2840-263-23, section 73-21-01, para. 1.A through 1.D.

21 Aug 1998
3. AUTO/MANUAL CHANGEOVER SOLENOID CIRCUIT FAULT

A

AT CONNECTOR 1P2, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.
SOCKETS LIMITS (Q) NOM (Q)
F & G 9 - 19 13

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

No

AT CONNECTOR J4, MEASURE RESISTANCE OF THE SOLENOID WINDING IN THE HMU.
PINS LIMITS (Q) NOM (Q)
U & V 9 - 19 13

PIN-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

No

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- START THE ENGINE AND OPERATE AT GROUND IDLE. SELECT MANUAL MODE AND THEN AUTO MODE.
- VERIFY PROPER ENGINE OPERATION AND ABSENCE OF FAULTS

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
4. OVERSPEED SYSTEM POWER-UP SELF TEST FAULT

ASSOCIATED FAULT INDICATION(S):
OSTat2 Fil, OSTat3 Fil, OSTat4 Fil, OSTat5 Fil, OSTat6 Fil, OSTat7 Fil.

DESCRIPTION:
The ECU indicates a problem with the ECU/HMU OVERSPEED SHUT-OFF SOLENOID CIRCUIT DURING POWER-UP

POSSIBLE CAUSES:
• Mating connectors on ECU, harnesses or HMU loose or damaged
• Harness failure
• HMU OVERSPEED SHUT-OFF SOLENOID failure
• ECU failure

PROCEED AS FOLLOWS TO RESOLVE:

• DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

• IS CONNECTOR TIGHT?

• TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

• RECONNECT 1A6P1
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
• USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

DOES FAULT STILL EXIST?

• PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

• AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.
  SOCKETS LIMITS (Ω) NOM (Ω)
  35 & 45 21 - 45 30
  48 & 34 21 - 45 30
  SOCKET-TO-GROUND: >1 MEGOHM

HAS ECU ALREADY BEEN REPLACED?


REINSTALL THE ORIGINAL ECU. REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

ARE PINS OR SOCKETS BENT, RECESSEd OR MISSING?

• REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
  • THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
  • THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
  • THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

21 AUG 1998
4. OVERSPEED SYSTEM POWER-UP SELF TEST FAULT

**A**

AT CONNECTOR 1P2, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.

<table>
<thead>
<tr>
<th>SOCKET LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H &amp; M</td>
<td>21 - 45</td>
</tr>
<tr>
<td>N &amp; b</td>
<td>21 - 45</td>
</tr>
</tbody>
</table>

SOCKET-TO-GROUND: >1 MEGÔHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

No → AT CONNECTOR J4, MEASURE RESISTANCE OF THE SOLENOID WINDING IN THE HMU.

<table>
<thead>
<tr>
<th>PIN LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L &amp; K</td>
<td>21 - 45</td>
</tr>
<tr>
<td>H &amp; J</td>
<td>21 - 45</td>
</tr>
</tbody>
</table>

PIN-TO-GROUND: >1 MEGÔHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARAS 2.A AND 2.B

No → REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARAS 1.A THROUGH 1.D

**B**

VERIFICATION PROCEDURE:

- WITH THROTTLE TWIST GRIP IN CUT-OFF POSITION, DEPOWER AND REPOWER AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-245-23, TASK 9-3-11 & -10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED AND VERIFY THAT FAULTS ARE NO LONGER INDICATED.

PERFORM ANY REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE
5. METERING VALVE POSITION POTentiOMETER CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S): WtmvFit, WtmvRgFit, WtmvRtFit

DESCRIPTION:
The ECU indicates a problem with the ECU/ HMU metering valve position potentiometer circuit.

POSSIBLE CAUSES:
- Mating connectors or harnesses or HMU loose or damaged
- Harness failure
- HMU metering valve position potentiometer failure
- ECU failure

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

No

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

A

(PG 2)

RECONNECT 1A6P1, POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

No

HAS ECU ALREADY BEEN REPLACED?

Yes


No

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS.

SOCKETS LIMITS (Q) NOM (Q)
54 & 55 4250-5750 5000
53 & 55 1000-1500 1200
53 & 54 3500-5250 4500

SOCKET-TO-GROUND: >1 MEGOHM

REINSTALL THE ORIGINAL ECU. REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

B

(PG 2)

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

No

DOES FAULT STILL EXIST?

Yes

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

No

21 AUG 1998
5. METERING VALVE POSITION POTENTIOMETER CIRCUIT FAULT

A

AT CONNECTOR 1P2, MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS.

Sockets Limits (Ω) Nom (Ω)
Q & Q 4250-5750 5000
I & S 1000-1500 1200
I & Q 3500-5250 4300

Socket-to-ground: >1 Megohm

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT 100% Np, AT LIGHT-ON -SKIDS POWER, AND VERIFY FAULT DOES NOT REAPPEAR

No

AT CONNECTOR J4, MEASURE RESISTANCE OF THE POTENTIOMETER IN THE HMU.

Pins Limits (Ω) Nom (Ω)
P & M 4250-5750 5000
N & M 1000-1500 1200
N & P 3500-5250 4300

Pin-to-ground: >1 Megohm

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

No

REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

RETURN TO SERVICE

21 AUG 1998
6. POWER LEVER ANGLE (THROTTLE POSITION) POTENTIOMETER CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
PLA12FII, PLA1FII, PLA1RgFII, PLA2FII, PLA2RgFII, PLADfII, PLAhFII, PLARIHfII, PLARIOfII

DESCRIPTION:
The ECU indicates a problem with the ECU/ HMU PLA position potentiometer circuit.

POSSIBLE CAUSES:
• Mating connectors on ECU, harnesses or HMU loose or damaged
• Harness failure
• HMU PLA stops positioned incorrectly
• HMU PLA position potentiometer failure
• ECU failure

PROCEED AS FOLLOWS TO RESOLVE:
• Depower aircraft (Similar to TM 55-1520-248-23, Task 9-3-11)
• Set PLA to ground idle position (35°)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

SET PLA TO CUTOFF POSITION (0°)

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

A

Yes

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
57 & 58 4250-5750 5000
56 & 58 4000-5700 4800
56 & 57 300-800 450

SOCKETS LIMITS (Ω)
51 & 52 SOCKETS 57 & 58 ± 15
50 & 52 SOCKETS 56 & 58 ± 15
50 & 51 SOCKETS 56 & 57 ± 15

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

B

Yes

REPLACE THE HMU
PER TM-1-2840-263-23,
SECTION 73-21-01,
PARA. 1.A THROUGH 1.D

No

C

(REPLACEMENT)

ARE CONNECTOR TIGHT?

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

NO

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

No

Yes

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
• THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
• THE ENGINE ELECTRICAL HARNESS (PER TM-1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
• THE HMU (PER TM-1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

21 AUG 1996
6. POWER LEVER ANGLE (THROTTLE POSITION) POTENTIOMETER CIRCUIT FAULT

A

AT CONNECTOR 1P2, MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
1 & 3 4250-5750 5000
2 & 4 2700-4300 3400
5 & 7 1300-2500 1800

SOCKETS LIMITS (Ω)
m & p SOCKETS 1 & 3 ± 15
n & q SOCKETS 2 & 4 ± 15
n & m SOCKETS 5 & 7 ± 15

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

B

SET PLA TO MAXIMUM POSITION (100°)

AT THE SAME CONNECTOR (1A6P1), MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
57 & 58 4250-5750 5000
56 & 58 700-1400 1000
56 & 57 3500-4900 4200

SOCKETS LIMITS (Ω)
51 & 52 SOCKETS 57 & 58 ± 15
50 & 52 SOCKETS 56 & 58 ± 15
50 & 51 SOCKETS 56 & 57 ± 15

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No

C

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

RECONNECT 1A6P1, POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER MOVING TWIST GRIP THROUGH FULL RANGE OF TRAVEL AND BACK TO CUTOFF

DOES FAULT STILL EXIST?

No

AA

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

Yes

REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

No

21 AUG 1998
6. **POWER LEVER ANGLE (THROTTLE POSITION) POTENTIOMETER CIRCUIT FAULT**

![Diagram of the power lever angle circuit fault checking process]

**HAS HMU ALREADY BEEN REPLACED?**

- **Yes**
  - REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

- **No**
  - VERIFICATION PROCEDURE:
    - POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
    - MOVE TWIST GRIP THROUGH FULL RANGE OF TRAVEL AND BACK TO CUTOFF
    - USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
    - OPERATE ENGINE AT 100% Np AND VERIFY FAULT DOES NOT REAPPEAR
  - PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

**RETURN TO SERVICE**

**REMARKS**

- 21 AUG 1998
7. CIT (T1) TEMPERATURE SENSOR CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
- T1AFII, T1AFII, T1ARgFI, T1ARgFI, T1BFII, T1BFII, T1BRgFI, T1BRgFI, T1DII

DESCRIPTION:
The ECU indicates a problem with the ECU/T1 sensor circuit.

POSSIBLE CAUSES:
- Mating connectors on ECU, harnesses, or T1 sensor loose or damaged
- Harness failure
- ECU failure
- T1 sensor failure

PROCEED AS FOLLOWS TO RESOLVE:

 DEPOWER AIRCRAFT
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

No

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

AT CONNECTOR T1A6P1, MEASURE RESISTANCE OF EACH OF THE T1 SENSOR ELEMENTS THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
68 & 69 85-140 100
70 & 69 0-5 0
71 & 72 85-140 100
73 & 72 0-5 0

SOCKET-TO-GROUND: >1 MEGOHM

No

RECONNECT T1A6P1, POWER UP AIRCRAFT AND CONTROL SYSTEM
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

DOES FAULT STILL EXIST?

Yes

PERFORM INTERMITTENT FAULT
PROCEDURE (TASK 33)

No

HAS T1 SENSOR ALREADY BEEN REPLACED?

Yes

REPLACE THE T1 SENSOR PER THE AIRCRAFT MM

No


ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE T1 SENSOR EXTENSION HARNESS (PER THE AIRCRAFT MM)
- THE T1 SENSOR (PER THE AIRCRAFT MM)

No

(Continued)
7. CIT (T1) TEMPERATURE SENSOR CIRCUIT FAULT

A

AT CONNECTOR 1P10, MEASURE RESISTANCE OF EACH OF THE T1 SENSOR ELEMENTS THROUGH THE HARNESS.

<table>
<thead>
<tr>
<th>PINS</th>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; C</td>
<td>85-140</td>
<td>100</td>
</tr>
<tr>
<td>B &amp; C</td>
<td>0-5</td>
<td>0</td>
</tr>
<tr>
<td>D &amp; F</td>
<td>85-140</td>
<td>100</td>
</tr>
<tr>
<td>E &amp; F</td>
<td>0-5</td>
<td>0</td>
</tr>
</tbody>
</table>

PIN-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

No → AT CONNECTOR 1A8J1, MEASURE RESISTANCE OF EACH OF THE T1 SENSOR ELEMENTS AT THE SENSOR.

<table>
<thead>
<tr>
<th>PINS</th>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; C</td>
<td>85-140</td>
<td>100</td>
</tr>
<tr>
<td>B &amp; C</td>
<td>0-5</td>
<td>0</td>
</tr>
<tr>
<td>D &amp; F</td>
<td>85-140</td>
<td>100</td>
</tr>
<tr>
<td>E &amp; F</td>
<td>0-5</td>
<td>0</td>
</tr>
</tbody>
</table>

PIN-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE T1 SENSOR EXTENSION HARNESS PER THE AIRCRAFT MM

No → REPLACE THE T1 SENSOR PER THE AIRCRAFT MM

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT 100% Np AND VERIFY FAULT DOES NOT REAPPEAR

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE
8. $N_p (N_2)$ SPEED SENSOR CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
$N_p$12Fl, $N_p$1CyFl, $N_p$1Fl, $N_p$1RgFl, $N_p$1RfFl, $N_p$2CyFl, $N_p$2Fl, $N_p$2RgFl, $N_p$2RfFl, $N_p$DFil

DESCRIPTION:
THE ECU INDICATES A PROBLEM WITH THE ECU/ $N_p$ SPEED SENSOR CIRCUIT

POSSIBLE CAUSES:
- MATING CONNECTORS ON ECU, HARNESSES, OR $N_p$ SENSOR LOOSE OR DAMAGED
- $N_p$ SENSOR FAILURE
- HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

No

RECONNECT 1A6P1, POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

A (PG 2)

No

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF EACH OF THE $N_p$ SENSOR ELEMENTS THROUGH THE HARNESS.

SOCKETS LIMITS (Q) NOM (Q)
32 & 33 250 - 500 350
24 & 25 250 - 500 350
SOCKET-TO-GROUND: >1 MEGOHM

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)


REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM-12840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)

START ENGINE AND OPERATE AT 100% $N_p$ OBSERVE MAINTENANCE TERMINAL FOR FAULT INDICATION.

DOES FAULT STILL EXIST?

Yes

No

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

B (PG 2)

No

21 AUG 1998
8. $N_p$ (N$_2$) SPEED SENSOR CIRCUIT FAULT

A

AT CONNECTOR 1P2, MEASURE RESISTANCE OF EACH OF THE $N_p$ SENSOR ELEMENTS THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)

<table>
<thead>
<tr>
<th>P &amp; R</th>
<th>250 - 500</th>
<th>350</th>
</tr>
</thead>
<tbody>
<tr>
<td>D &amp; D</td>
<td>250 - 500</td>
<td>350</td>
</tr>
</tbody>
</table>

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

No → AT CONNECTOR P6, MEASURE RESISTANCE OF EACH OF THE $N_p$ SENSOR ELEMENTS AT THE SENSOR.

SOCKETS LIMITS (Ω) NOM (Ω)

<table>
<thead>
<tr>
<th>P &amp; R</th>
<th>250 - 500</th>
<th>350</th>
</tr>
</thead>
<tbody>
<tr>
<td>D &amp; D</td>
<td>250 - 500</td>
<td>350</td>
</tr>
</tbody>
</table>

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B


B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT 100% $N_p$ AND VERIFY FAULT DOES NOT REAPPEAR

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE
9. \( N_\text{g} - (N_1) \) SPEED SENSOR CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
- Ng12Filt, Ng1CyFilt, Ng1Filt, Ng1RgFilt,
- Ng1RiFilt, Ng2CyFilt, Ng2Filt, Ng2RgFilt,
- Ng2RiFilt

DESCRIPTION:
The ECU indicates a problem with the ECU/\( N_\text{g} \) speed sensor circuit.

POSSIBLE CAUSES:
- Mating connectors on ECU, harnesses, or \( N_\text{g} \) sensor loose or damaged
- \( N_\text{g} \) sensor failure
- Harness failure
- ECU failure

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

YES

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

NO

RECONNECT 1A6P1, POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

YES

A (PG 2)

NO

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF EACH OF THE \( N_\text{g} \) SENSOR ELEMENTS THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)

40 & 41 250 - 500 350
36 & 37 250 - 500 350

SOCKET-TO-GROUND: >1 MEGOHM

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

YES

B (PG 2)

NO


REPLACE THE \( N_\text{g} \) SENSOR (PER MM TM1-2840-263-23, SECTION 73-21-00, PARA. 5.A AND 5.B)

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER MM TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE \( N_\text{g} \) SENSOR (PER MM TM1-2840-263-23, SECTION 73-21-00, PARA. 5.A AND 5.B)

21 AUG 1998
9. \( N_g (N_1) \) SPEED SENSOR CIRCUIT FAULT

A

AT CONNECTOR J2, MEASURE RESISTANCE OF EACH OF THE \( N_g \) SENSOR ELEMENTS THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
Z & A 250 - 500 350
S & T 250 - 500 350

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT GROUND IDLE AND VERIFY FAULT DOES NOT REAPPEAR

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

No

AT CONNECTOR J7, MEASURE RESISTANCE OF EACH OF THE \( N_g \) SENSOR ELEMENTS AT THE SENSOR.

PINS LIMITS (Ω) NOM (Ω)
A & B 250 - 500 350
C & D 250 - 500 350

PIN-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes → REPLACE THE ENGINE ELECTRICAL HARNESS PER MM TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

No

REPLACE THE \( N_g \) SENSOR (PER MM TM1-2840-263-23, SECTION 73-21-00, PARA. 5.A AND 5.B)

RETURN TO SERVICE

21 AUG 1998
10. MGT THERMOCouple CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
MGT95, MGR95, MGTR95

DESCRIPTION:
The ECU indicates a problem with the ECU/MGT THERMOCouple CIRCUIT.

POSSIBLE CAUSES:
- Mating connectors on ECU, harnesses, or thermocouple assembly loose or damaged
- Harness failure
- Thermocouple assembly or junction failure
- ECU failure
- Severe actual MGT conditions exceeding fault range or rate limits

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

CHECK THERMOCouple LUGS AT ENGINE TERMINAL BLOCK FOR TIGHTNESS, GOOD CONTACT TO STUDS, AND ABSENCE OF CONTACT BETWEEN LUGS OF OPPOSITE STUDS.

ARE CONNECTIONS PROPER?

Yes
- TIGHTEN OR CORRECT LUG CONNECTIONS TO STUDS AT ENGINE T/C TERMINAL BLOCK

No

ARE PINS OR SOCKETS BENT, RECEDED OR MISSING?

Yes
- AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

No

IS CONNECTOR TIGHT?

Yes
- BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

No
- TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE MGT THERMOCouple ELEMENTS THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
76 & 79 0-10 5

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes
- RECONNECT 1A6P1, POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 10B15)

No

DOES FAULT STILL EXIST?

Yes
- PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

No

21 AUG 1998
10. MGT THERMOCOUPLE CIRCUIT FAULT

**AA**

- REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

**C**

**VERIFICATION PROCEDURE:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-249-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT 100% Np AND VERIFY FAULT DOES NOT REAPPEAR

**PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED**

**RETURN TO SERVICE**

21 AUG 1998
11. PERMANENT MAGNET ALTERNATOR (PMA) CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
A128FI

DESCRIPTION:
The ECU indicates a problem with the ECU/Permanent Magnet Alternator Circuit

POSSIBLE CAUSES:
- PMA Failure
- Mating Connectors on ECU, Harnesses or PMA Loose or Damaged
- Harness Failure
- ECU Failure

PROCED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?
Yes
TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

No

AT CONNECTOR I16P1, MEASURE RESISTANCE OF THE PMA THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
26 & 27 0.5 - 4.0 1.5
27 & 28 0.5 - 4.0 1.5
SOCKET-TO-GROUND: >1 MEGOHM

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?
Yes

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

No

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?
No

A (PG 2)

B (PG 2)

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

REPLACE PMA PER TM1-2840-263-23, SECTION 73-20-01, PARA. 1.A AND 1.B

AN Y PMA-RELATED FAULT INDICATIONS?
Yes

B (PG 2)

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE PMA (PER TM1-2840-263-23, SECTION 73-20-01, PARA. 1.A AND 1.B)

21 AUG 1998

EDR 18692 Page C-23
11. PERMANENT MAGNET ALTERNATOR (PMA) CIRCUIT FAULT

A

AT CONNECTOR 1P2, MEASURE RESISTANCE OF THE PMA THROUGH THE HARNESS.

<table>
<thead>
<tr>
<th>SOCKETS</th>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>J &amp; K</td>
<td>0.5 - 4.0</td>
<td>1.5</td>
</tr>
<tr>
<td>K &amp; L</td>
<td>0.5 - 4.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

No

AT CONNECTOR J11, MEASURE RESISTANCE OF THE PMA ON THE ENGINE.

<table>
<thead>
<tr>
<th>SOCKETS</th>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; B</td>
<td>0.5 - 4.0</td>
<td>1.5</td>
</tr>
<tr>
<td>B &amp; C</td>
<td>0.5 - 4.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

No

REPLACE PMA PER TM1-2840-263-23, SECTION 73-20-01, PARA. 1.A AND 1.B

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, AND VERIFY THAT NO FAULTS ARE SHOWING.
- START THE ENGINE AND SLOWLY ADVANCE TWIST GRIP (THROTTLE) TO 86% Np, WITH ROTOR AT FLAT PITCH, AND DWELL FOR AT LEAST 10 SECONDS.
- VERIFY NO CURRENT FAULTS ON MAINTENANCE TERMINAL
- IF OPERATION SATISFACTORY, MAINTAIN ROTOR AT FLAT PITCH AND SLOWLY INCREASE TWIST GRIP POSITION TO 100% Np
- VERIFY NO CURRENT FAULTS ON MAINTENANCE TERMINAL

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
12. TORQUE (TMOP OR Q) MEASUREMENT FAULT

ASSOCIATED FAULT INDICATION(S):
QFII, QRGFI, QRIFI, QVDFII

DESCRIPTION:
The ECU indicates a problem with the torque measurement circuit or a significant signal error.

POSSIBLE CAUSES:
- Mating connectors on ECU, harnesses or TMOP sensor loose or damaged
- TMOP sensor failure
- Harness failure
- Torque pressure problem in engine gearbox
- ECU failure
- In-range T1 signal error

PROCEED AS FOLLOWS TO RESOLVE:

CONNECT MAINTENANCE TERMINAL AND CHECK CURRENT AND LAST ENGINE RUN FAULTS

IS FAULT CODE QVDFII INDICATED?

NO

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

21 AUG 1998

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- The FADEC interface harness (Per the aircraft MM)
- The engine electrical harness (Per TM 1-2840-263-23, Section 73-21-00, PARA. 2.A AND 2.B)
- The ECU (Per the aircraft MM and TM 1-2840-263-23, Section 73-25-01, PARA. 4.A THROUGH 4.C)
- The TMOP sensor (Per TM 1-2840-263-23, Section 77-15-01, PARA. 2)

YES

SELECT REAL TIME DATA - ANALOG PARAMETERS ON MAINTENANCE TERMINAL
- FACE AIRCRAFT INTO PREVAILING WIND
- OPERATE ENGINE AT 100% Np AND CHECK MAINTENANCE TERMINAL T1 INDICATION AGAINST AIRCRAFT OAT GAGE

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

NO

YES

B (PG 3)

A (PG 2)
12. TORQUE (TMOP OR Q) MEASUREMENT FAULT

A

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE TMOP SENSOR THROUGH THE HARNESS.
- SOCKETS 64 & 65
  - LIMITS (Ω)
  - 1000-2000
- SOCKETS 66 & 67
  - LIMITS (Ω)
  - 500-2000
- SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

- RECONNECT 1A6P1.
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- START ENGINE AND OPERATE AT 100% Np
- USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY

B

(PG 3)

DOES FAULT STILL EXIST?

Yes

- RESOLVE THE ENGINE TORQUE SYSTEM PROBLEM PER TM1-2840-263-23, CHAPTER 72-00-00, TABLE 101, AND RELATED SUPPLEMENTARY TROUBLE-SHOOTING SEQUENCES.

No

- PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

(PG 3)

HAS TMOP SENSOR ALREADY BEEN REPLACED?

Yes


No

- HAS ECU ALREADY BEEN REPLACED?

Yes


No

- REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

21 AUG 1998
12. TORQUE (TMOP OR Q) MEASUREMENT FAULT

A

AT CONNECTOR J10, MEASURE RESISTANCE OF THE TMOP SENSOR AT THE TRANSDUCER.

<table>
<thead>
<tr>
<th>Pins</th>
<th>Limits (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; B</td>
<td>1000-2000</td>
</tr>
<tr>
<td>C &amp; D</td>
<td>500-2000</td>
</tr>
</tbody>
</table>

PIN-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No

REPLACE THE TMOP SENSOR PER TM1-2840-263-23, SECTION 77-15-01, PARA. 2

Yes

REPLACE THE ENGINE ELECTRICAL HARNES PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- START THE ENGINE AND OPERATE AT 100% Np.
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
ASSOCIATED FAULT INDICATION(S):
CPAntFit, CFFit, CPRgFit

DESCRIPTION:
The ECU indicates a problem with the ECU/collective pitch position potentiometer circuit.

POSSIBLE CAUSES:
• Mating connectors on ECU, harnesses or CP potentiometer loose or damaged
• CP potentiometer failure
• Aircraft collective pitch potentiometer rigging exceeds normal travel limits
• Harness failure
• ECU failure

PROCEED AS FOLLOWS TO RESOLVE:

• DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
• SET COLLECTIVE PITCH LEVER TO ABOUT 50% (NEAR MID-TRAVEL) POSITION

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

YES

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

NO

ARE CONNECTOR 1A6P2, MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS:
SOCKETS LIMITS (Ω) NOM (Ω)
64 & 65 4250 - 5750 5000
AND SUM OF RESISTANCE VALUES BETWEEN SOCKETS 63 & 65 AND BETWEEN SOCKETS 63 & 64 EQUAL TO OR GREATER THAN RESISTANCE BETWEEN SOCKETS 64 & 65
SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

YES

C (PG 2)

NO

HOLD COLLECTIVE PITCH LEVER FULL DOWN AND MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS:
SOCKETS LIMITS (Ω) NOM (Ω)
64 & 65 4250 - 5750 5000
63 & 65 700 - 1300 1000
63 & 64 3200 - 4900 4000
SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

YES

B (PG 2)

NO

CHECK CP POTENTIOMETER RIGGING (RANGE OF MOTION AND POSITION ADJUSTMENTS) PER TM 1-2840-263-23, AND SIMILAR TO TM 55-1520-248-23, TASK 11-2-1

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

YES

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

NO
13. COLLECTIVE PITCH (CP) POTENTIOMETER CIRCUIT FAULT

A

IS RIGGING CORRECT?

Yes

- REPLACE THE CP POTENTIOMETER AND RIG PER TM 1-2840-263-23, ALSO SIMILAR TO TM 55-1520-248-23, TASK 11-2-1

- CORRECT THE CP POTENTIOMETER RIGGING PER TM 1-2840-263-23

No

AT POTENTIOMETER SIDE OF CONNECTOR 1MT10P1, MEASURE RESISTANCE OF THE CP POTENTIOMETER PINS LIMITS (Ω) NOM (Ω)

C & A 4250 - 5750 5000

- AND-

SUM OF RESISTANCE VALUES BETWEEN PINS B & A AND BETWEEN PINS B & C EQUAL TO OR GREATER THAN RESISTANCE BETWEEN PINS C & A

PIN-TO-GROUND: >1 MEGOHM

B

- RECONNECT 1A6P2.
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- POSITION THROTTLE TWIST GRIP AT GROUND IDLE.
- USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY WHILE MOVING COLLECTIVE PITCH LEVER THROUGH WIDEST POSSIBLE RANGE OF TRAVEL, INCLUDING HARD AGAINST MINIMUM STOP.

D (PG 3)

REPLACE THE CP POTENTIOMETER, SIMILAR TO TM 55-1520-248-23, TASK 11-2-1, AND RIG PER TM 1-2840-263-23

D (PG 3)


D

HAS CP POTENTIOMETER ALREADY BEEN REPLACED?

Yes

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

No

DOES FAULT STILL EXIST?

Yes

REPLACE (OR REPAIR) THE INTERCONNECTING AIRCRAFT WIRING BETWEEN THE CP POTENTIOMETER AND THE ECU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

21 AUG 1998
REV. 12 JULY 99
13. COLLECTIVE PITCH (CP) POTENTIOMETER CIRCUIT FAULT

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- POSITION THROTTLE TWIST GRIP AT GROUND IDLE AND MOVE COLLECTIVE PITCH LEVER THROUGH WIDEST RANGE OF TRAVEL ACHIEVABLE

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
14. N_R SPEED SENSOR CIRCUIT FAULT

**ASSOCIATED FAULT INDICATION(s):**
NcAnt, NcPm1, NcPm2, NcRx1, NcRx2

**DESCRIPTION:**
THE ECU INDICATES A PROBLEM WITH THE ECU/ Nc SPEED SENSOR CIRCUIT

**POSSIBLE CAUSES:**
- MATING CONNECTORS ON ECU, HARNESS OR Nc SENSOR LOOSE OR DAMAGED
- Nc SENSOR FAILURE
- HARNESS FAILURE
- ECU FAILURE

PROCED AS FOLLOWS TO RESOLVE:

- DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

**RECONNECT 1A6P2, POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)**

**DOES FAULT STILL EXIST?**
- **YES**
  - PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)
- **NO**

**ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?**
- **A (PG 2)**
  - AT CONNECTOR 1A6P2, MEASURE RESISTANCE OF THE Nc SENSOR ELEMENT THROUGH THE HARNESS.
    - **SOCKETS LIMITS (Ω) NOM (Ω)**
    - 29 & 30 800-1600 1200
    - SOCKET-TO-GROUND: >1 MEGOHM

**IS CONNECTOR TIGHT?**
- **YES**
  - AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS
  - TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

- **NO**
  - ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?
    - **YES**
      - REPLACE (OR REPAIR) WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
        - THE AIRCRAFT WIRING HARNESS BETWEEN THE Nc SENSOR EXTENSION HARNESS AND THE ECU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)
        - THE Nc SENSOR EXTENSION HARNESS (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)
        - THE Nc SENSOR (SIMILAR TO TM 55-1520-248-23)

  - **NO**
14. \( N_r \) SPEED SENSOR CIRCUIT FAULT

A

AT CONNECTOR 1P3, MEASURE RESISTANCE OF THE \( N_r \) SENSOR ELEMENT THROUGH THE HARNES.

**PINS**

<table>
<thead>
<tr>
<th>LIMITS (Ω)</th>
<th>NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 &amp; 5</td>
<td>800-1600</td>
</tr>
</tbody>
</table>

PIN-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNES BETWEEN THE \( N_r \) SENSOR INTERFACE HARNES AND THE ECU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

No

REPLACE THE \( N_r \) SENSOR PER AIRCRAFT MM TM 55-1520-248-23

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT 100% \( N_p \) WITH \( N_g > 71\% \) AND VERIFY FAULT DOES NOT REAPPEAR

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

08 SEP 1998
ASSOCIATED FAULT INDICATION(S):
P1F1, P1HdF1, P1RgF1, P1RIF1

DESCRIPTION:
THE ECU INDICATES A PROBLEM WITH THE P1 PRESSURE TRANSDUCER LOCATED WITHIN THE ECU

POSSIBLE CAUSES:
• TRANSDUCER FAILURE
• PLUGGED OR CLOGGED HOLES IN P1 SENSOR CAP

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

CHECK P1 CAP ON ECU FOR ANY VISIBLE DAMAGE.

IS CAP DAMAGED IN ANY WAY?

Yes

NO

CHECK HOLES IN P1 CAP ON ECU FOR BLOCKAGE BY FOREIGN OBJECTS OR CONTAMINATION

ARE CAP HOLES BLOCKED?

Yes

CLEAR BLOCKAGE FROM THE HOLES

No


PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

VERIFICATION PROCEDURE:
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
• USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
• OPERATE ENGINE AT 100% Np AND VERIFY FAULT DOES NOT REAPPEAR

21 AUG 1998
ASSOCIATED FAULT INDICATION(S):
AD12IFIT, AD8BIFIT, ARINCHWFIT, BacCompFIt, BVIIFIT, CJCIFIT, CJCRIIFIT, ECUOTFIF, EECaIFIT, EEHistFIt, EEPROMFIt, ForCompFIt, GainFIt, GainRgFIt, HLRIFIT, HLRIRgFIt, IgnFIt, Not Used, OffsFIt, OffsRgFIt, CrDiodeFIt, OSVFIIF, OSVRgFIt, PROMFIt, PW10FIt, PW10RgFIt, RAMFIt, StrFIt, SWIntFIt, UARTFIt, UUInfFIt, V15FIt, V15RgFIt, V5FIt, V5RgFIt, WDTFIt, WDTOuFIt

DESCRIPTION:
THE ECU INDICATES A PROBLEM INTERNAL TO THE ECU

POSSIBLE CAUSES:
• ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

NOTE: DO NOT START ENGINE UNTIL THIS STEP IS PERFORMED:
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10),
• USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS AND LAST ENGINE RUN FAULTS DISPLAYS AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)
• TABULATE FAULT CODES DISPLAYED


ARE ALL ORIGINALLY REPORTED FAULT CODES STILL PRESENT?

YES

ARE ANY OF THE ABOVE LISTED FAULT CODES PRESENT?

NO

YES

INITIAL FAULT CODES WERE MISREPORTED. IF ANY OTHER FAULT CODES ARE SHOWING, ISOLATE AND REPAIR PER THE APPLICABLE PROCEDURE

RETURN TO SERVICE

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

VERIFICATION PROCEDURE:
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
• USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
• OPERATE ENGINE AT 100% Np AND VERIFY FAULTS DO NOT REAPPEAR

21 AUG 1998
ASSOCIATED FAULT INDICATION(S):
AF28f/JP, AF28f/G/FL.

DESCRIPTION:
The ECU indicates a problem with the airframe 28VDC supply to the ECU.

POSSIBLE CAUSES:
- Weak battery, power interrupts, or airframe 28VDC supply failure.
- Mating connectors on ECU or harnesses loose or damaged.
- Poor aircraft ground path.
- Harness failure.
- ECU failure.

PROCEED AS FOLLOWS TO RESOLVE:

1. DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11).
2. BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.
3. IS CONNECTOR TIGHT?
   - Yes: NEXT 
   - No: NEXT
4. TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE.
5. AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS.
6. ARE PINS OR SOCKETS BENT, RECEssED OR MISSING?
   - Yes: NEXT 
   - No: NEXT
7. DEPENDING UPON FINDINGS:
   - REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU.
   - SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV.
   - OR -

21 AUG 1998
17. AIRFRAME 28VDC SUPPLY FAULT

A

TURN ON FADEC POWER (CIRCUIT BREAKER 1CB15), USING AIRCRAFT BATTERY

AT CONNECTOR 1A6P2, CHECK FOR PRESENCE OF +28VDC, FROM CONNECTOR SOCKET 25 TO ECU GROUND STRAP. LIMIT IS 28 ± 1 VDC

IS VOLTAGE WITHIN LIMITS?

No

REPEAT MEASUREMENT OF VOLTAGE FROM CONNECTOR 1A6P2, SOCKET 25, TO ECU GROUND STRAP, WITH LANDING LIGHT (OR EQUIVALENT) ON

Yes

DOES FAULT STILL EXIST OR ECU FAIL TO POWER UP?

No

PERFORM INTermittent FAULT PROCEDURE (TASK 33)

Yes


IS VOLTAGE STILL WITHIN 28 ± 1VDC LIMITS?

No

RECONNECT ALL CONNECTORS. POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY

Yes

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (CIRCUIT BREAKER 1CB15)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT 100% Np, AND PERFORM GENERATOR SWITCHING AND APPLICATION OF AIRCRAFT ELECTRICAL LOADS AS WOULD OCCUR IN NORMAL FLIGHT.
- VERIFY THAT FAULT DOES NOT REAPPEAR

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
18. OVERSPEED SYSTEM PUSH-TO-TEST SWITCH CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
OSTatSwFlt

DESCRIPTION:
The ECU INDICATES A PROBLEM WITH THE ECU/OVERSPEED PUSH-TO-TEST SWITCH CIRCUIT

POSSIBLE CAUSES:
* SWITCH FAILURE OR SWITCH HELD ON FOR MORE THAN 30 SECONDS
* MATING CONNECTORS ON ECU, HARNESSSES, OR MCPU LOOSE OR DAMAGED
* HARNESS FAILURE
* ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

HAS SWITCH BEEN HELD ON FOR MORE THAN 30 SECONDS?
No

THERE IS NO PROBLEM. CHANGE OPERATING PROCEDURE TO ASSURE OVERSPEED SYSTEM FUNCTIONAL TEST IS COMPLETED WITHIN 30 SECONDS OF DEPRESSING SWITCH.

RETURN TO SERVICE

Yes

IS CONNECTOR TIGHT?

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

No

AT CONNECTOR 1A6P2, SOCKET 44, MEASURE SWITCH RESISTANCE TO GROUND THROUGH THE HARNESS.

SWITCH POSITION LIMITS (Ω)
OVERSPEED TEST < 1
NORMAL (NO TEST) ≥ 100k

ARE MEASUREMENTS WITHIN LIMITS?

No

Yes

A

(PG 2)

B

(PG 2)

* TROUBLE SHOOT THE OVERSPEED SYSTEM PUSH-TO-TEST SWITCH IN THE LEFT MCPU (ON MFD BEZEL) AND/OR
* REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS BETWEEN THE ECU AND THE COCKPIT LEFT MCPU (OR ASSOCIATED MFD UNIT), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

DEPENDING UPON FINDINGS:

21 AUG 1998

EDR 18882
18. OVERSPEED SYSTEM PUSH-TO-TEST
SWITCH CIRCUIT FAULT

A

AT CONNECTOR 1A6P2,
SOCKET 44, MEASURE SWITCH
RESISTANCE TO GROUND
THROUGH THE HARNESS
WHILE SWITCHING BETWEEN
STATES

SWITCH POSITION LIMITS (Ω)
OVERSPEED TEST < 1
NORMAL (NO TEST) > 100K

EVIDENCE OF
STICKING DURING
STATE CHANGES?

Yes

NO

REPLACE MFD UNIT
ASSOCIATED WITH
LEFT MCPU (3431A1)
PER AIRCRAFT MM

B

VERIFICATION
PROCEDURE:

• POWER UP
AIRCRAFT AND
CONTROL SYSTEM
(SIMILAR TO TM 55-
1520-248-23, TASK 9-3-
10)
• USE MAINTENANCE
TERMINAL, WITH
CURRENT FAULTS
DISPLAY SELECTED
• HOLD DOWN
OVERSPEED PRESS-
TO-TEST SWITCH FOR
FIVE SECONDS AND
RELEASE.
• VERIFY THAT THE
RELEVANT FAULTS
ARE NO LONGER
INDICATED.
• START ENGINE,
OPERATE AT GROUND
IDLE, AND PERFORM
AN OVERSPEED
SHUTDOWN TEST
• VERIFY THAT FAULT
DOES NOT REAPPEAR

DOES
FAULT STILL
EXIST?

Yes

No

PERFORM
INTERMITTENT FAULT
PROCEDURE (TASK 33)

PERFORM ANY OTHER
REQUIRED RUNNING
CHECKS OR
MAINTENANCE CHECK
FLIGHTS NORMALLY
ASSOCIATED WITH
THE REPAIRS OR
PARTS CHANGES
ACCOMPLISHED

RETURN TO SERVICE

REPLACE THE ECU
PER THE AIRCRAFT
MM AND TM1-2840-253-
23, SECTION 73-25-01,
PARA. 4.A THROUGH
4.C

21 AUG 1998
19. FADEC MODE SWITCH CIRCUIT FAULT

**Associated Fault Indication(s):**
AM3SwF0t

**Description:**
The ECU indicates a problem with the ECU/FADEC mode switch circuit

**Possible Causes:**
- Mating connectors on ECU, harnesses, or cockpit instrument panel loose or damaged
- Switch failure
- ECU failure
- Harness failure

Proceed as follows to resolve:

- Depower aircraft (similar to TM 55-1520-248-23, task 9-3-11)

Before disconnecting any connector, first check for looseness as possible cause of fault.

**Is Connector Tight?**

Yes

Tighten the connector, ensuring proper keying between the mating plug and receptacle

No

**Does Fault Still Exist?**

Yes

Reconnect A6P2. Power up aircraft and control system (similar to TM 55-1520-248-23, task 9-3-10). Using maintenance terminal, check current faults. Display after switching from auto to manual to auto.

No

Perform intermittent fault procedure (task 33)

**Are Resistance Measurements Within Limits?**

Yes

No

(A (PG 2)

**AT Connector A6P2, Measure Switch Resistance to Ground Through the Harness.**

**Switch Pos.** | **Socket Limits (Ω)**
--- | ---
Auto | 45 <1
Auto | 49 >100K
Auto | 12 >100K
Manual | 45 >100K
Manual | 69 <1
Manual | 12 <1

Replace the ECU per the aircraft MM and TM 1-2840-263-23, section 73-25-01, Para. 4.A through 4.C

B (PG 2)

Depending upon findings: Replace (or repair) the aircraft wiring harness connected to the ECU and to the cockpit FADEC auto-manual switch similar to TM 55-1520-248-23, Appendix K, section IV - or - Replace the ECU (per the aircraft MM and MM TM 1-2840-263-23, section 73-25-01, Para. 4.A through 4.C)

B (PG 2)

21 Aug 1998
19. FADEC MODE SWITCH CIRCUIT FAULT

A

TROUBLESHOOT, REPAIR, OR REPLACE THE FADEC AUTO-MANUAL SWITCH AND/OR THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE FADEC AUTO-MANUAL SWITCH SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

B

VERIFICATION PROCEDURE:

• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
• USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED
• SELECT MANUAL MODE THEN AUTO MODE TO VERIFY NO FAULT SHOWING IN EITHER MODE.
• START ENGINE (IN AUTO MODE) AND OPERATE AT GROUND IDLE
• SELECT MANUAL MODE THEN AUTO MODE TO VERIFY PROPER TRANSITION INTO EACH MODE
• VERIFY THAT FAULT DOES NOT REAPPEAR

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1999
20. IGNITION CIRCUIT FAULT

ASSOCIATED FAULT INDICATION(S):
IgniFit

DESCRIPTION:
THE ECU INDICATES A PROBLEM WITH THE IGNITION CIRCUIT

POSSIBLE CAUSES:
- RELAY OR SWITCH FAILURE IN AIRCRAFT IGNITION CIRCUIT
- MATING CONNECTORS ON ECU OR AIRCRAFT HARNESS LOOSE OR DAMAGED
- HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING ECU POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C (PG 2)

No

DID IGNITION SYSTEM ACTIVATE?

Yes

B (PG 2)

No

A (PG 2)

FTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

No

Yes

C (PG 2)

C (PG 2)


21 AUG 1998

EDR 19882
20. IGNITION CIRCUIT FAULT

A

- DEPOWER AIRCRAFT
  (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
- RECONNECT AIRCRAFT
  HARNESS CONNECTOR 1A6P2 TO ECU
- CONNECT MAINTENANCE
  TERMINAL, WITH CURRENT
  FAULTS DISPLAY SELECTED
- POWER UP AIRCRAFT
  (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11).
- PERFORM A NORMAL ENGINE
  START

DOES

FAULT

STILL

EXIST?

No

Yes

C

VERIFICATION

PROCEDURE:

- POWER UP
  AIRCRAFT AND
  CONTROL SYSTEM
  (SIMILAR TO TM 55-
  1520-248-23, TASK 9-3-
  10)
- USE MAINTENANCE
  TERMINAL, WITH
  CURRENT FAULTS
  DISPLAY SELECTED,
  TO VERIFY THAT THE
  RELEVANT FAULT IS
  NO LONGER
  INDICATED.
- PERFORM ENGINE
  START TO GROUND
  IDLE
- VERIFY THAT FAULT
  DOES NOT REAPPEAR

PERFORM ANY OTHER
REQUIRED RUNNING
CHECKS OR
MAINTENANCE CHECK
FLIGHTS NORMALLY
ASSOCIATED WITH
THE REPAIRS OR
PARTS CHANGES
ACCOMPLISHED

RETURN TO SERVICE

B

TROUBLESHOOT,
REPAIR, OR REPLACE
THE IGNITION RELAY
(1AK8), THE FADEC
AUTO-MANUAL
SWITCH, AND/OR THE
AIRCRAFT WIRING
HARNESS CONNECTED
TO THE ECU AND TO
THE IGNITION RELAY
AND FADEC AUTO-
MANUAL SWITCH,
SIMILAR TO TM 55-
1520-248-23, APPENDIX
K, SECTION IV

HAS ECU
ALREADY BEEN
REPLACED?

No

Yes

PERFORM
INTERMITTENT FAULT
PROCEDURE (TASK 33)

REPLACE THE ECU
PER THE AIRCRAFT
MM AND TM1-2840-263-
23, SECTION 73-25-01,
PARA. 4.A THROUGH
4.C
ASSOCIATED FAULT INDICATION(S):
StepCntFit, WISIFit, WISIRgFit

DESCRIPTION:
METERING VALVE POSITION FEEDBACK SIGNAL NOT IN AGREEMENT WITH ECU-COMMANDED POSITION, OR THE STEPPER MOTOR POSITION IS OUT OF RANGE

POSSIBLE CAUSES:
• MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
• HARNESS FAILURE
• HMU METERING VALVE, STEPPER MOTOR, OR FEEDBACK POTENTIOMETER IN-RANGE FAILURE
• ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE

IS FAULT CODE SmFit INDICATED?

Yes

PERFORM TASK 1

No

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

IS CONNECTOR TIGHT?

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C (PG 2)

No

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

A (PG 2)

Yes

RECONNECT 1A5P1
• PLACE TWIST GRIP IN CUTOFF POSITION
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
• CYCLE FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER CB15)
• MOTOR ENGINE ON STARTER
• USE MAINTENANCE TERMINAL TO CHECK CURRENT FAULTS
• IF NO FAULTS START ENGINE AND RUN TO 100% Np

B (PG 2)

No

AT CONNECTOR 1A5P1, MEASURE RESISTANCE OF EACH OF 4 STEPPER MOTOR WINDINGS THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
1 & 5 20 - 40 30
2 & 5 20 - 40 30
3 & 5 20 - 40 30
4 & 5 20 - 40 30

SOCKET-TO-GROUND: >1 MEGOHM

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

21 AUG 1998

No

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

C (PG 2)

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
• THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
• THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.4 AND 2.8)
• THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)
21. STEP COUNT FAULT

A

AT CONNECTOR J4, MEASURE RESISTANCE OF EACH OF 4 STEPPER MOTOR WINDINGS THROUGH THE HARNESS.

<table>
<thead>
<tr>
<th>SOCKETS LIMITS (Ω) NOM (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; E 20-40 30</td>
</tr>
<tr>
<td>B &amp; E 12-40 30</td>
</tr>
<tr>
<td>C &amp; E 20-40 30</td>
</tr>
<tr>
<td>D &amp; E 20-40 30</td>
</tr>
</tbody>
</table>

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No → REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

Yes → PERFORM INTERMITTENT FAULT PROCEDURE 33

B

DOES FAULT STILL EXIST?

No → PERFORM INTERMITTENT FAULT PROCEDURE 33

Yes → YES → REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

HAS HMU ALREADY BEEN REPLACED?

Yes → REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

No → REINSTALL THE ORIGINAL HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D


C

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)
- PLACE TWIST GRIP IN CUTOFF POSITION
- MOTOR ENGINE ON STARTER
- USE MAINTENANCE TERMINAL TO VERIFY NO CURRENT FAULTS
- START ENGINE AND RUN TO 100% Np
- VERIFY NO CURRENT FAULTS

PERFORM ANY OTHER RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
ASSOCIATED FAULT INDICATION(S):
OpenMvFig

DESCRIPTION:
HMU METERING VALVE IS OPEN PRIOR TO ENGINE START

POSSIBLE CAUSES:
• AIRCRAFT BATTERY TURNED OFF AT SHUTDOWN, BEFORE ENGINE STOPPED ROTATING
• THROTTLE OPENED AT SHUTDOWN, BEFORE ENGINE STOPPED ROTATING
• ENGINE WAS NOT SHUT DOWN USING NORMAL SHUTDOWN PROCEDURES
• NEWLY INSTALLED HMU WAS NOT MOTORED WITH THROTTLE IN CUTOFF POSITION
• HMU METERING VALVE WAS NOT CLOSING PROPERLY, OR SPRINGING OPEN AFTER POWERDOWN
• HMU POTENTIOMETER MISADJUSTED OR FAILED IN-RANGE

PROCEED AS FOLLOWS TO RESOLVE:

YES

DOES FAULT STILL EXIST?

RETURN TO SERVICE

NO

REPLACE THE HMU PER TM1-2840-263-23 SECTION 73-21-01, PARA. 1.A THROUGH 1.D

YES

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

VERIFICATION PROCEDURE:
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
• CONNECT MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, AND CYCLE FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)
• WITH CONTROL SYSTEM IN AUTO MODE, VERIFY NO CURRENT FAULTS SHOWING

21 AUG 1998
ASSOCIATED FAULT INDICATION(S):
OSTstFlt

DESCRIPTION:
The ECU indicates a problem with the overspeed system during engine shutdown test.

POSSIBLE CAUSES:
- HMU overspeed shut off solenoid failure
- ECU failure
- Mating connectors on ECU, harnesses or HMU loose or damaged
- Harness failure

PROCEED AS FOLLOWS TO RESOLVE:

CONNECT MAINTENANCE TERMINAL AND CHECK CURRENT AND LAST ENGINE RUN FAULTS

IS FAULT CODE NposFlt INDICATED?

PERFORM TASK 24

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

No

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

No

B (PG 2)

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
35 & 45 21-45 30
34 & 46 21-45 30

SOCKET-TO-GROUND: >1 MEGOHM

AT CONNECTOR 1P2, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.

SOCKETS LIMITS (Ω) NOM (Ω)
H & M 21-45 30
N & b 21-45 30

SOCKET-TO-GROUND: >1 MEGOHM

A (PG 2)

C (PG 3)

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:
- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM 1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE HMU (PER TM 1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

21 AUG 1998
23. OVERSPEED SYSTEM ENGINE SHUTDOWN TEST FAULT

A

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No

REPLACE THE FADEC INTERFACE HARNESS PER THE AIRCRAFT MM

Yes

AT CONNECTOR J4, MEASURE RESISTANCE OF THE SOLENOID WINDING IN THE HMU.

PIN TO GROUND: >1 MEGOHM

L & K 21-45 30
H & J 21-45 30

PIN LIMITS (Q) NOM (Q)

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

No

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

REPLACE THE ENGINE ELECTRICAL HARNESS PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B

B

• RECONNECT 1A6P1.
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
• CONNECT MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED
• OPERATE ENGINE AT GROUND IDLE AND TEST OVERSPEED SHUTDOWN SYSTEM AT LEAST TWO TIMES
• OBSERVE MAINTENANCE TERMINAL FOR CURRENT FAULT INDICATIONS AFTER EACH OVERSPEED SHUTDOWN TEST

Does fault still exist?

Yes

PERFORM INTERMITTENT FAULT PROCEDURE 33

Has ECU already been replaced?

Yes


No


C (PG 3)

21 AUG 1998
23. OVERSPEED SYSTEM ENGINE SHUTDOWN TEST FAULT

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- CONNECT MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED.
- OPERATE ENGINE AT GROUND IDLE AND TEST OVERSPEED SHUTDOWN SYSTEM.
- REPEAT A SECOND TIME TO TEST THE ALTERNATE CHANNEL.
- OBSERVE CURRENT FAULTS DISPLAY ON MAINTENANCE TERMINAL AFTER EACH OVERSPEED SHUTDOWN TEST TO VERIFY NO FAULTS INDICATED.

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED.

RETURN TO SERVICE

21 AUG 1999
ASSOCIATED FAULT INDICATION(S):
Np0SFit

DESCRIPTION:
The ECU indicates a problem with the speed signals as measured by the overspeed circuits in the ECU

POSSIBLE CAUSES:
• ECU failure

PROCEED AS FOLLOWS TO RESOLVE:
• Power up aircraft and control system (similar to TM 55-1520-248-23, task 9-3-10)
• Connect maintenance terminal and determine current faults and last engine run faults

THE FOLLOWING FAULT CODES ARE NOT RELATED TO THE FAULT COVERED BY THIS TASK:
Np1Fit, Np2Fit, Np12Fit

ARE ANY (OR ALL) OF THESE CODES SHOWN?

No

PERFORM TASK 8

Yes

VERIFYATION PROCEDURE:
• Power up aircraft and control system (similar to TM 55-1520-248-23, task 9-3-10)
• Connect maintenance terminal, with current faults display selected
• Operate engine at ground idle and test overspeed shutdown system
• Repeat a second time to test the alternate channel
• Observe current faults display on maintenance terminal after each overspeed shutdown test to verify no faults indicated

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE


21 AUG 1998
ASSOCIATED FAULT INDICATION(S):
WDTTimeOut

DESCRIPTION:
WATCHDOG TIMER TRIPPED

POSSIBLE CAUSES:
• ECU FAILURE (SOFTWARE EXECUTION CYCLE NOT PROPERLY COMPLETED)

PROCEED AS FOLLOWS TO RESOLVE:

VERIFICATION PROCEDURE:
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
• CONNECT MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED
• CYCLE FADEC POWER OFF AND ON (CIRCUIT BREAKER 1CB15)
• START ENGINE AND OPERATE AT 100% Np WITH FLAT PITCH ROTOR
• OBSERVE MAINTENANCE TERMINAL AND VERIFY NO CURRENT FAULTS INDICATED

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
26. UNUSED DISCRETE INPUT FAULT

**Most Likely Fault Indication:**
TestCelFit

**Description:**
The ECU incorrectly indicates that an unused discrete input signal is active (shorted to ground)

**Possible Causes:**
- Mating connector on ECU or harness damaged
- Incorrect harness installed

Proceed as follows to resolve:

1. Depower aircraft (similar to TM 55-1520-248-23, task 9-3-11)
2. Before disconnecting any connector, first check for looseness as possible cause of fault.

- **Is connector tight?**
  - Yes: After disconnecting any connector, immediately examine pins and sockets.
  - No: Tighten the connector, ensuring proper keying between the mating plug and receptacle.

- **Is socket installed?**
  - Yes: At connector 1A6P2, measure resistance to ground through the harness at socket 58. (If no socket installed no measurement required) Limit >1 MΩ Nominal open
  - No: Replace the ECU per the Aircraft MM and TM1-2840-263-23, Section 73-25-01, Para. 4.A through 4.C

- **Replace (or repair) the aircraft wiring harness similar to TM 55-1520-248-23, Appendix K, Section IV**

**21 Aug 1998**
**26. UNUSED DISCRETE INPUT FAULT**

**Verification Procedure:**
- Power up aircraft and control system (similar to TM 55-1520-248-23, Task 9-3-10)
- Connect maintenance terminal, with current faults display selected, and cycle FADEC power off and on (FADEC circuit breaker 1CB15)
- Verify no current faults showing

Perform any other required running checks or maintenance check flights normally associated with the repairs or parts changes accomplished

Return to service
27. INCORRECT MAINTENANCE MESSAGE CODES

ASSOCIATED FAULT INDICATION(S):
ARINCFltAn, CPDFlt, FTempFlt, LoadSelFlt,
LoadShdFlt, NgOFlt, NgOrgFlt, NgOrFlt,
Not Used, NdFlt, P1DFlt.

DESCRIPTION:
The ECU indicates fault codes that are not valid for this installation.

POSSIBLE CAUSES:
* Installed ECU is not correct configuration
* Maintenance terminal data files corrupted or wrong configuration
* ECU failure

PROCEED AS FOLLOWS TO RESOLVE:

CHECK PART NUMBER
OF INSTALLED ECU TO
VERIFY IT IS CORRECT

IS ECU PART
NUMBER CORRECT?

Yes

DO INCORRECT
FAULTS STILL
EXIST?

Yes

PROBLEM RESOLVED -
RETURN TO SERVICE

No

REPLACE THE ECU
PER THE AIRCRAFT
MM AND TM1-2840-263-
23, SECTION 73-25-01,
PARA. 4.A THROUGH
4.C

No

REPLACE THE ECU
PER THE AIRCRAFT
MM AND TM1-2840-263-
23, SECTION 73-25-01,
PARA. 4.A THROUGH
4.C

RELOAD
MAINTENANCE
TERMINAL DATA FILES
INTO MAINTENANCE
TERMINAL USING
KNOWN GOOD DISKS
* POWER UP
AIRCRAFT AND
CONTROL SYSTEM
(SIMILAR TO TM 55-
1520-248-23, TASK 9-3-
10).
* CONNECT MAINTENANCE
TERMINAL, WITH
CURRENT FAULTS
DISPLAY SELECTED
* CYCLE FADEC
POWER OFF AND ON
(FADEC CIRCUIT
BREAKER 1CB15)

VERIFICATION
PROCEDURE:
* POWER UP
AIRCRAFT AND
CONTROL SYSTEM
(SIMILAR TO TM 55-
1520-248-23, TASK 9-3-
10).
* CONNECT MAINTENANCE
TERMINAL, WITH
CURRENT FAULTS
DISPLAY SELECTED
* CYCLE FADEC
POWER OFF AND ON
(FADEC CIRCUIT
BREAKER 1CB15)
* OBSERVE
MAINTENANCE
TERMINAL AND VERIFY
NO CURRENT FAULTS
INDICATED

PERFORM ANY OTHER
REQUIRED RUNNING
CHECKS OR
MAINTENANCE CHECK
FLIGHTS NORMALLY
ASSOCIATED WITH
THE REPAIRS OR
PARTS CHANGES
ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998
28. SECONDARY FAULT CODES

ASSOCIATED FAULT INDICATION(S):
AMFlt, HardFlt, Or28Flt, Or28RgFlt,
OSFlt, TempFlt, W1HdFlt.

DESCRIPTION:
A SECONDARY FAULT CODE IS BEING INDICATED
BY THE ECU, WHICH IS NORMALLY GENERATED
AS A RESULT OF OTHER EXISTING FAULT CODES

POSSIBLE CAUSES:
• OTHER FADEC SYSTEM FAULTS HAVE OCCURRED

PROCEED AS FOLLOWS TO RESOLVE:

PERFORM ALL OTHER MAINTENANCE TASKS
ASSOCIATED WITH THE OTHER DISPLAYED FAULT CODES

VERIFICATION PROCEDURE:
• PERFORM VERIFICATION PROCEDURES
  SPECIFIED FOR THE OTHER FAULT CODES DISPLAYED.
• CONNECT MAINTENANCE TERMINAL, WITH
  CURRENT FAULTS DISPLAY SELECTED
• OBSERVE MAINTENANCE TERMINAL AND VERIFY
  NO CURRENT FAULTS INDICATED

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR
MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH
THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE
29. ENGINE LIMITS EXCEEDED

ASSOCIATED FAULT INDICATION(S):
- MGTLMOut, MGRRLmOut, MGTSLtOut, MGTSRLmOut,
- NgLtOut, NgRLmOut, NpLtOut, NpQEkLtAdv,
- NpQnRrLtAdv, OSFlag, QLmOut, QRtLmOut

DESCRIPTION:
The ECU indicates that engine performance limits have been exceeded.

POSSIBLE CAUSES:
- Engine operational problem
- Aircraft operational problem

PROCEED AS FOLLOWS TO RESOLVE:
- Using maintenance terminal, download engine maintenance history from ECU.
- Review magnitude and duration of exceedences.
- Compare exceedence values from maintenance terminal with those registered by the cockpit multi-function display (upon which engine maintenance decisions are based).

MAINT TERMINAL GENERALLY AGREE WITH MFD?

Yes

SELECT REAL TIME DATA DISPLAY ON MAINTENANCE TERMINAL.
- Start engine and operate at 100% Np at light on skids power. Compare readings of Np, Ng, MGT, and torque between the maintenance terminal and the cockpit gages.
- In the event of disagreement, resolve differences in accordance with TM1-2840-263-23, Chapter 72-00-00, Table 101, and related supplementary troubleshooting sequences.

VERIFICATION PROCEDURE:
- Verify that limits exceedence information has been reviewed and appropriate maintenance actions taken, prior to running the engine.
- Power up aircraft and control system (similar to TM 55-1520-248-23, TASK 9-3-10).
- Cycle FADEC power off and on (FADEC circuit breaker TC1B15).
- Connect maintenance terminal, with CURRENT FAULTS DISPLAY SELECTED.
- Start engine and operate at 100% Np with flat pitch rotor.
- Observe maintenance terminal and verify no CURRENT FAULTS INDICATED.

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED.

RETURN TO SERVICE

Does MFD show limits exceedences?

No

Yes

**PERFORM MAINTENANCE ACTIONS INDICATED BY MFD-RECORDED EXCEEDENCE VALUES, IN ACCORDANCE WITH TM1-2840-263-23**
- Document actions and clear MFD engine history per existing procedures.

21 AUG 98
30. FUEL FLOW LIMIT EXCEEDED

ASSOCIATED FAULT INDICATION(S):
WILimFlag

DESCRIPTION:
THE ECU INDICATES THAT FUEL FLOW HAS EXCEEDED A MAXIMUM FUEL FLOW VERSUS CORRECTED Ng LIMIT

POSSIBLE CAUSES:
• FAULT UPON INITIAL INSTALLATION OF ECU REFLECTS PAST INSTALLATION OR TEST BENCH FAULT
• CONTAMINATION OR RESTRICTION IN FUEL SYSTEM
• HMU FAILURE
• IN-RANGE T1 SENSOR ERROR

PROCEED AS FOLLOWS TO RESOLVE:

DID FAULT APPEAR ON INITIAL ECU INSTALLATION, PRIOR TO ENGINE RUN?

Yes
FAULT REFLECTS PAST OPERATING CONDITION ON PREVIOUS ENGINE INSTALLATION OR TEST BENCH OPERATION.

No
EVIDENCE OF FUEL CONTAMINATION?

Yes
• DEFUEL, FLUSH, AND REFUEL AIRCRAFT FUEL SYSTEM SIMILAR TO AIRCRAFT MAINTENANCE MANUAL TM 55-1520-248-23, TASKS 1-4-3 AND 1-4-2
• CLEAN ENGINE FUEL FILTER ASSEMBLY AND REPLACE ELEMENT PER TM1-2840-263-23, SECTION 73-10-01, PARA. 2.B AND 2.C.
• PURGE HMU PER TM1-2840-263-23, SECTION 73-00-00, PARA. 1.B.

No
EVIDENCE OF FUEL CONTAMINATION?

Yes
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-246-23, TASK 9-3-10).
• CONNECT MAINTENANCE TERMINAL AND SELECT REAL TIME DATA - ANALOG PARAMETERS
• COMPARE INDICATION OF ENGINE T1 SENSOR, AS INDICATED BY MAINTENANCE TERMINAL, WITH ACTUAL AIR TEMPERATURE IN THE LOCALITY OF THE T1 SENSOR
NOTE: THIS Requires REMOVAL OF AIR INLET COWL (SIMILAR TO AIRCRAFT MAINTENANCE MANUAL TM 55-1520-248-23, TASK 4-2-1) FOR ACCESS TO T1 SENSOR TO ALLOW MEASUREMENT OF LOCALITY TEMPERATURE

A (PG 2)

IS T1 WITHIN 10°F OF LOCALITY TEMPERATURE?

Yes

No
B (PG 2)
REPLACE T1 SENSOR

21 AUG 1998
30. FUEL FLOW LIMIT EXCEEDED

A

REPLACE THE HMU PER TM1-2840-253-23, SECTION 75-21-01, PARA. 1.A THROUGH 1.D

B

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- CONNECT MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED
- OPERATE ENGINE AT 100% Np, WITH FLAT ROTOR PITCH AND AT LIGHT-ON-SKIDS POWER
- OBSERVE MAINTENANCE TERMINAL AND VERIFY NO CURRENT FAULTS INDICATED

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMAL ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE
**ASSOCIATED FAULT INDICATION(S):**
BeepFlt

**DESCRIPTION:**
THE ECU INDICATES A PROBLEM WITH THE ECU/ROTOR SPEED TRIM "BEEPER" SWITCH CIRCUIT

**POSSIBLE CAUSES:**
- MATING CONNECTORS ON ECU, AIRCRAFT HARNESS, OR BEEPER SWITCH LOOSE OR DAMAGED
- ROTOR SPEED BEEPER SWITCH FAILURE
- ECU FAILURE
- AIRCRAFT HARNESS FAILURE

**PROCEED AS FOLLOWS TO RESOLVE:**

1. DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
2. BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.
3. IS CONNECTOR TIGHT?
   - Yes
   - No
     - TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE
4. AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS
5. ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?
   - Yes
     - DEPENDING UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS, OR THE ROTOR SPEED BEEPER SWITCH, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV
6. **AT CONNECTOR 4A2J1, MEASURE SWITCH RESISTANCE ACROSS PINS AT THE SWITCH**
   - SWITCH POS.
   - PINS
   - LIMITS (Ω)
   - NO BEEP 4 & 5 > 100k
   - NO BEEP 6 & 5 > 100k
   - BEEP UP 4 & 5 < 1
   - BEEP UP 6 & 5 > 100k
   - BEEP DOWN 4 & 5 > 100k
   - BEEP DOWN 6 & 5 < 1
7. ARE MEASUREMENTS WITHIN LIMITS?
   - Yes
   - No
8. **AT CONNECTOR 4A6P2, MEASURE SWITCH RESISTANCE TO GROUND THROUGH HARNESS**
   - SWITCH POS.
   - SOCKET
   - LIMITS (Ω)
   - NO BEEP 38 > 100k
   - NO BEEP 41 > 100k
   - BEEP UP 38 < 1
   - BEEP UP 41 > 100k
   - BEEP DOWN 38 > 100k
   - BEEP DOWN 41 < 1
9. ARE MEASUREMENTS WITHIN LIMITS?
   - Yes
   - No
10. **REPLACE THE ROTOR SPEED BEEPER SWITCH ASSEMBLY (4A2) SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV**

**DATE:** 21 AUG 1998
31. ROTOR SPEED TRIM "BEEPER" SWITCH CIRCUIT FAULT

A
- REATTACH CONNECTOR 1A6P2 TO ECU.
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CONNECT MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED
- BEEP UP THEN DOWN THEN UP (BE SURE BEEP SWITCH IS DEPRESSED FOR LESS THAN 20 SECONDS)

C
VERIFICATION PROCEDURE:
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED
- BEEP UP THEN DOWN THEN UP (BE SURE BEEP SWITCH IS DEPRESSED FOR LESS THAN 20 SECONDS)
- VERIFY THAT THE FAULT IS NO LONGER INDICATED.
- START ENGINE AND OPERATE AT 100% Np.
- BEEP UP AND DOWN AND VERIFY THAT Np SHOWS PROPER RESPONSE

B
- REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

DOES FAULT STILL EXIST?
- Yes
- No

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)


RETURN TO SERVICE
32. ROTOR SPEED TRIM "BEEPER" SWITCH STUCK

ASSOCIATED FAULT INDICATION(S): BpStuckFlip

DESCRIPTION:
THE ECU INDICATES A PROBLEM WITH THE ECU/ROTOR SPEED TRIM "BEEPER" SWITCH CIRCUIT

POSSIBLE CAUSES:
- MATING CONNECTORS ON ECU, AIRCRAFT HARNESS, OR BEEPER SWITCH LOOSE OR DAMAGED
- ROTOR SPEED BEEPER SWITCH FAILURE
- ECU FAILURE
- AIRCRAFT HARNESS FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

YES

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

NO

AT CONNECTOR 1A6P2, MEASURE SWITCH RESISTANCE TO GROUND THROUGH HARNESS

SWITCH POS SOCKET LIMITS (Ω)
NO BEEP 38 > 100K
NO BEEP 41 > 100K

DEPENDING UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS, OR THE ROTOR SPEED BEEPER SWITCH, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV
- OR -

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

YES

NO

ARE MEASUREMENTS WITHIN LIMITS?

YES

A (Pg 2)

NO

B (Pg 2)

C (Pg 2)
32. ROTOR SPEED TRIM "BEEPER" SWITCH STUCK

A

TOGGLE THE BEEPER SWITCH SEVERAL TIMES FROM BEEP UP TO BEEP DOWN AND BACK TO NEUTRAL, WHILE CONTINUING TO MEASURE SWITCH RESISTANCE TO GROUND THROUGH HARNESS AT CONNECTOR 1A6P2, AT SOCKET 38 AND 41 IN TURN,

<table>
<thead>
<tr>
<th>SWITCH POS.</th>
<th>PIN</th>
<th>LIMITS (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO BEEP</td>
<td>38</td>
<td>&gt; 100K</td>
</tr>
<tr>
<td>NO BEEP</td>
<td>41</td>
<td>&gt; 100K</td>
</tr>
</tbody>
</table>

EVIDENCE OF SWITCH STICKING?

No

REATTACH CONNECTOR 1A6P2 TO ECU.

Power Up Aircraft and Control System (Similar to TM 55-1520-248-23, TASK 9-3-10)

- Connect Maintenance Terminal, with Current Faults Display Selected
- Cycle FADEC Power Off and On (FADEC Circuit Breaker 1CB15)
- Observe Current Faults for at least two minutes

Yes

B

AT CONNECTOR 4A2J1, MEASURE SWITCH RESISTANCE ACROSS PINS AT THE SWITCH

<table>
<thead>
<tr>
<th>SWITCH POS.</th>
<th>PINS</th>
<th>LIMITS (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO BEEP</td>
<td>4 &amp; 5</td>
<td>&gt; 100K</td>
</tr>
<tr>
<td>NO BEEP</td>
<td>6 &amp; 5</td>
<td>&gt; 100K</td>
</tr>
</tbody>
</table>

ARE MEASUREMENTS WITHIN LIMITS?

No

REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

Yes

REPLACE THE ROTOR SPEED BEEPER SWITCH ASSEMBLY (4A2) SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

C

VERIFY PROPER PROCEDURE:

- Power Up Aircraft and Control System (Similar to TM 55-1520-248-23, TASK 9-3-10)
- Use Maintenance Terminal, with Current Faults Display Selected
- Cycle FADEC Power Off and On (FADEC Circuit Breaker 1CB15)
- Observe Current Faults for at least two minutes and verify that the fault is no longer indicated.
- Start engine and operate at 100% Np.
- BEEP UP AND DOWN AND VERIFY THAT Np SHOWS PROPER RESPONSE

Replace the Aircraft MM and TM1-2840-263-23, Section 73-25-01, Para. 4.A through 4.C

Perform any other required running checks or maintenance check flights normally associated with the repairs or parts changes accomplished

RETURN TO SERVICE

10 AUG 1998

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

Does Fault Still Exist?

No

Yes

21 AUG 1998
33. INTERMITTENT FAULT PROCEDURE

DESCRIPTION:
A fault was detected by the ECU but it does not currently exist. No cause for its occurrence or reason for its correction was identified.

POSSIBLE CAUSES:
- Loose pins or sockets in connectors
- Poor crimp connections in harnesses
- Deteriorated wire insulation or intermittent shorting
- Poor signal quality of sensors
- Marginal component performance or failure in ECU
- Marginal component performance or failure in HMU
- Contamination in fuel handling components

PROCEED AS FOLLOWS TO RESOLVE:

PERFORM APPLICABLE BASELINE PROCEDURES FROM TABLE 33-1 IN THE ORDER LISTED, OR UNTIL PROBLEM IS CORRECTED.

IS PROBLEM CORRECTED?

PERFORM APPLICABLE SPECIAL PROCEDURES FROM TABLE 33-1 IN THE ORDER LISTED, UNLESS REQUIRED SPECIAL EQUIPMENT IS NOT AVAILABLE.

HAVE SPECIAL PROCEDURES BEEN PERFORMED?

HAS PROBLEM BEEN IDENTIFIED?

ARE PRECAUTIONARY LRU REPLACEMENTS APPLICABLE AS PER TABLE 33-1?

PERFORM RECOMMENDED PRECAUTIONARY LRU REPLACEMENT AS PER TABLE 33-1

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

MONITOR SUBSEQUENT OPERATIONS FOR POSSIBLE RECURRENCE OF SOFT FAULT CONDITION

PERFORM VERIFICATION PROCEDURE:

PERFORM VERIFICATION PROCEDURE SPECIFIED BY THE ORIGINAL TASK FOR THE SPECIFIC FAULT

RETURN TO SERVICE

09 SEP 1998

EDR 18882  Page C-62
### TABLE 33-1

<table>
<thead>
<tr>
<th>TASK</th>
<th>BASELINE PROCEDURE</th>
<th>SPECIAL PROCEDURE</th>
<th>PRECAUTIONARY LRU REPLACEMENT*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1, 2, 3, 7</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1, 2, 3, 7</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>2, 3, 7, 1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>4A, 1</td>
<td>2, 3, 7, 1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4C, 1</td>
<td>2, 3, 7, 1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>2, 4C, 5, 3, 7, 1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>2, 4C, 6, 3, 7, 1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>2, 4C</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>2, 4E</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>2, 4C</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>4B, 1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>2, 4D</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>2, 4F</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>2</td>
<td>9, 1, 8</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>2, 4D, 2, 3, 7</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>2, 4C</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

### BASELINE AND SPECIAL FAULT PROCEDURES:

1. **COMPREHENSIVE HARNESS AND CONNECTOR CHECK**
   Repeat all circuit resistance and insulation resistance checks listed in the original task for the fault being investigated, including those checks omitted in following the logical sequence of task steps. Insulation resistance should be checked between the circuit and ground, and between the circuit and other pins. Flex the harnesses if possible while making resistance measurements to detect intermittent shorts/opens. Concurrently, check for connector looseness, damaged pins or recessed sockets as possible cause of fault at every connection listed in the original task.

2. **CONNECTOR SOCKET RETENTION CHECK**
   Perform socket retention check specified by Bell AMM procedure at all applicable interface harness or airframe harness connection points identified in the original task for the fault being investigated.

**NOTE TO REVIEWER:** BHT CONNECTOR SOCKET RETENTION CHECK PROCEDURE MUST BE TRANSCRIBED FROM 407 MAINTENANCE MANUAL AND INSERTED HERE.
33. **INTERMITTENT FAULT PROCEDURE**

**BASELINE AND SPECIAL FAULT PROCEDURES (Cont.)**

**WARNING:** FOLLOW APPROPRIATE SAFETY PRACTICES TO AVOID PERSONAL INJURY/SHOCK FROM THE HIGH VOLTAGE TEST.

**CAUTION:** ALL CONNECTIONS OF THE PARTICULAR HARNESS MUST BE DISCONNECTED PRIOR TO PERFORMING THE 100-VOLT INSULATION RESISTANCE CHECK TO AVOID POTENTIAL DAMAGE TO COMPONENTS.

3. **XXX-VOLT INSULATION RESISTANCE CHECK**

Perform a 100-volt insulation resistance check for the engine harness, interface harness, or airframe harness at pins/sockets applicable per the original task for the fault being investigated. Consult applicable engine manufacturer or airframe manufacturer 100-volt insulation resistance test procedures for the particular harness being tested.

4. **MAINTENANCE TERMINAL SIGNAL MONITORING CHECKS**

A. With engine shut down, move throttle hard against first the minimum and then the maximum stop. Monitor signals listed in Table 33-2 for the task associated with the fault code, against the fault range limits listed in Table 33-2. Replace HMU if PLA signal exceeds the normal range of 0° to 100° by more than 2°, or if signal quality indicates probability of fault limit exceedence.

B. Move collective pitch lever hard against the minimum stop. Monitor signals listed in Table 33-2 for the task associated with the fault code, against the fault range limits listed in Table 33-2. Readjust or replace collective pitch potentiometer if signal is not 0±5% when at the minimum stop.

C. Run engine at ground idle and monitor signals listed in Table 33-2 for the task associated with the fault code. Check signal quality considering whether signal could be exceeding rate or range fault limits listed in Table 33-2, or if value of signal is unreasonable for operating condition. Flex harnesses carrying signal (being careful to avoid damaging harness and using caution to avoid personal contact with rotating or hot components), if possible while monitoring signal, to determine if intermittent signal change is evident with harness flexing. If poor signal quality is suspected, replace LRU which is the source of the signal and recheck signal quality. If intermittent is evident by flexing harness, replace suspect harness.

D. Same as C, except run engine at 100% Np,

E. Run engine at 85% Np, flat pitch rotor, with airframe electrical power to ECU turned OFF (breaker 1CB15 pulled).

**CAUTION: REVERSION TO MANUAL MODE POSSIBLE DURING THIS PROCEDURE**

Monitor signals listed in Table 33-2 for the task associated with the fault code. Flex harnesses carrying signal (being careful to avoid damaging harness and using caution to avoid personal contact with rotating of hot components), if possible while monitoring signal, to determine if intermittent signal change is evident with harness flexing. Replace PMA if signal is within 0.5 volts of fault limits, or if ECU loses power. If intermittent is evident by flexing harness, replace suspect harness.
F. With engine shut down and power being supplied by battery, monitor signals listed in Table 33-2 for the task associated with the fault code, against limits of Table 33-2. Apply electrical loads representative of conditions in flight and verify limits of Table 33-2 are not exceeded. If conditions are exceeded, troubleshoot aircraft battery or electrical system. Flex harnesses carrying signal (being careful to avoid damaging harness), if possible while monitoring signal, to determine if intermittent signal change is evident with harness flexing. If intermittent is evident by flexing harness, replace suspect harness.

<table>
<thead>
<tr>
<th>TASK</th>
<th>SIGNAL</th>
<th>RANGE LIMIT</th>
<th>RATE-OF-CHANGE LIMIT</th>
<th>DIFFERENCE LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>WfmvrRaw</td>
<td>-121.7 pph to 568.0 pph</td>
<td>962.5 pph/sec</td>
<td>IPlA1Raw - PLA2Raw &lt; 5°</td>
</tr>
<tr>
<td>6</td>
<td>PLA1Raw</td>
<td>-5° to 110°</td>
<td></td>
<td>IPlA1Raw - PLA2Raw &lt; 5°</td>
</tr>
<tr>
<td></td>
<td>PLA2Raw</td>
<td>-5° to 110°</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PLA1RRaw</td>
<td>4.95 to 5.05 volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>T1ARaw</td>
<td>-75°F to 225°F</td>
<td>200°F/sec</td>
<td>IT1ARaw - T1BRaw &lt; 30°F</td>
</tr>
<tr>
<td></td>
<td>T1BRaw</td>
<td>-75°F to 225°F</td>
<td>200°F/sec</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Np1Raw</td>
<td>20% to 160% (Nq &gt; 71%)</td>
<td>400%/sec</td>
<td>INp1Raw - Np2Raw &lt; 5%</td>
</tr>
<tr>
<td></td>
<td>Np2Raw</td>
<td>20% to 160% (Nq &gt; 71%)</td>
<td>400%/sec</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ng1Raw</td>
<td>8% to 130% (Engine Running)</td>
<td>375%/sec</td>
<td>INg1Raw - Ng2Raw &lt; 5%</td>
</tr>
<tr>
<td></td>
<td>Ng2Raw</td>
<td>8% to 130% (Engine Running)</td>
<td>375%/sec</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>MGTRaw</td>
<td>-77°F to 2400°F</td>
<td>2000°F</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>AI28Raw</td>
<td>8.5 to 60 volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AllRipRaw (Ripple)</td>
<td>&lt; 3.0 volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>QRaw (100% = 524 ft-lbs)</td>
<td>-10% to 200% (Normal Limits)</td>
<td>1500%/sec</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[5% to 200% (if Nq &gt; 85%, not Decelerating)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>CPRaw (100% = Full Up)</td>
<td>-14.4% to 110%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>NrRaw</td>
<td>40% to 150% (Nq &gt; 71%)</td>
<td>400%/sec</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>P1Raw</td>
<td>5.0 psia to 16.0 psia</td>
<td>40 psi/sec</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>AF28Raw</td>
<td>8.5 to 35.0 volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>WfStp</td>
<td>-121.7 pph to 568.0 pph</td>
<td></td>
<td>IWfStp - WfmvrRaw &lt; 42 pph</td>
</tr>
<tr>
<td></td>
<td>WfmvrRaw</td>
<td>-121.7 pph to 568.0 pph</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>WfmvrRaw</td>
<td>&lt; 13 to 16 pph Prior to Start</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>NpA1Raw</td>
<td></td>
<td></td>
<td>INpA1Raw - Npi &lt; 2.5%</td>
</tr>
<tr>
<td></td>
<td>NpA2Raw</td>
<td></td>
<td></td>
<td>INpA2Raw - Npi &lt; 2.5%</td>
</tr>
<tr>
<td></td>
<td>NpA3Raw</td>
<td></td>
<td></td>
<td>INpA3Raw - Npi &lt; 2.5%</td>
</tr>
<tr>
<td></td>
<td>NpA4Raw</td>
<td></td>
<td></td>
<td>INpA4Raw - Npi &lt; 2.5%</td>
</tr>
<tr>
<td></td>
<td>Np</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 33-2**
ASSOCIATED FAULT INDICATIONS:
AD128HIT, AD8BHIT, AMSOIFIL, AMSWFL, ECOUTFIL, GainFIL, HLRFIL, Ng12FIL, Np12FIL, OfisFIL, PH1dFIL, PLAhDFl, POMFl, PW10FIL, RAMFIL, SmFIL, StepCntFIL, T1AFIL, V15FIL, V5FIL, WDTTimeOut, WiHDFl, WISIFIL

DESCRIPTION:
A FADEC FAIL WARNING IS DISPLAYED ON MFD BUT NO CURRENT HARD FAULTS ARE INDICATED

POSSIBLE CAUSES:
- ECU NOT POWERED, OR FAILURE OF AIRCRAFT POWER SUPPLY TO ECU
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

YES

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

NO

DISCONNECT CONNECTOR 1A6F2 AT ECU
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CHECK FOR PRESENCE OF 28 VDC POWER AT SOCKET 25. MEASURE BETWEEN SOCKET AND GROUND STRAP. LIMIT 28 ± 1 VDC

IS VOLTAGE WITHIN LIMITS?

YES

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE DISPLAYED FAULT CODES

NO

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

YES

DEPENDING UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE DISCRETE INDICATORS KEYBOARD UNIT [3431A3], SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

- OR -


C (PG 2)

NO

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE DISPLAYED FAULT CODES

A (PG 2)

B (PG 2)

25 AUG 1998
34. **FADEC FAIL WARNING (MFD) INCORRECTLY "ON"**

**A**
- Using a jumper, ground socket 13 of connector 1A6P2 to ECU ground strap

**B**
- Troubleshoot aircraft 28 VDC supply per Task 17

**C**
- Troubleshoot, repair, or replace the aircraft wiring harness, the discrete indicators keyboard unit (3431A3), or MCU, similar to TM 55-1520-248-23, Appendix K, Section IV

**Verification Procedure:**
- Power up aircraft and control system (similar to TM 55-1520-248-23, Task 9-3-10)
- Cycle FADEC power off and on (breaker 1CB15)
- With engine shut down and throttle in cutoff, use maintenance terminal, with current faults display selected, to verify that no listed associated faults are active.
- Introduce a hard fault by disconnecting the Ng pickup (connector P7)
- With maintenance terminal, verify that a hard fault now exists (Ng12Ft) and that MFD FADEC fail warning is displayed.
- Reconnect Ng pickup, cycle FADEC power, and verify that fault is cleared and that FADEC fail warning is cleared.

**Perform any other required running checks or maintenance check flights normally associated with the repairs or parts changes accomplished.**

Return to service.

25 Aug 1998
ASSOCIATED FAULT INDICATION(S):
AD12StIfit, ADBBStIfit, AMSciIfit, AMSwIfit, ECAtIfit, GainStIfit, HLRFIfit, Ng12StIfit, Np12StIfit, OffStIfit, PIHdStIfit, PLAhdStIfit, PROMStIfit, PW10StIfit, RAMStIfit, SmStIfit, StepCntStIfit, T1ABStIfit, V15StIfit, V5StIfit, WDTTimeOut, WHdStIfit, WStIfit

DESCRIPTION:
A FADEC FAIL WARNING IS NOT DISPLAYED ON MFD WHEN CURRENT HARD FAULTS EXIST

POSSIBLE CAUSES:
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

ANY OF LISTED ASSOCIATED FAULTS ACTIVE?

MFD IS CORRECTLY REPORTING CURRENT STATUS

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECEDED, OR MISSING?

DEPENDING UPON FINDINGS, REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE DISCRETE INDICATORS KEYBOARD UNIT (3451A3), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

- OR -
REPLACE THE ECU (PER THE AIRCRAFT MM AND MM TM1-2840-263-23, SECTION 73-25-01, PARA 4 A THROUGH 4 C)

C (PG 2)

POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (CIRCUIT BREAKER IC815)
- USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY

IS FADEC FAIL DISPLAYED?

24 AUG 1998
35. **FADEC FAIL WARNING (MFD) INCORRECTLY "OFF"**

**A**

**B**
- TROUBLESHOOT, REPAIR, OR REPLACE THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR MCPU, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

**C**
- **VERIFICATION PROCEDURE:**
  - POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
  - CYCLE FADEC POWER OFF AND ON (CIRCUIT BREAKER 1CB15)
  - WITH ENGINE SHUT DOWN AND THROTTLE IN CUTOFF, USE MAINTENANCE TERMINAL, WITH CURRENT FAULTS DISPLAY SELECTED, TO VERIFY THAT NO LISTED ASSOCIATED FAULTS ARE ACTIVE.
  - INTRODUCE A HARD FAULT BY DISCONNECTING THE Ng PICKUP (CONNECTOR P7)
  - WITH MAINTENANCE TERMINAL, VERIFY THAT A HARD FAULT NOW EXISTS (Ng12Flt) AND THAT MFD FADEC FAIL WARNING IS DISPLAYED.
  - RECONNECT Ng PICKUP, CYCLE FADEC POWER, AND VERIFY THAT FAULT IS CLEARED AND THAT FADEC FAIL WARNING IS CLEARED

**ANY FAULT CODES DISPLAYED?**
- **No**
  - PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE DISPLAYED FAULT CODES
- **Yes**
  - PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE
36. **FADEC MANUAL WARNING (MFD) INCORRECTLY "ON"**

**DESCRIPTION:**

A FADEC MANUAL WARNING IS DISPLAYED ON MFD BUT CONTROL IS OPERATING IN THE AUTO MODE.

**POSSIBLE CAUSES:**

- UNCOMMANDED SWITCHOVER TO MANUAL DUE TO FAULT, OR MODE SWITCH INDICATION INCORRECT
- ECU NOT POWERED, OR FAILURE OF AIRCRAFT POWER SUPPLY TO ECU
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-20, TASK 9-3-10)

- IS FADEC MANUAL WARNING DISPLAYED?

  - Yes → SYSTEM OPERATION IS SATISFACTORY (FADEC MANUAL WARNING IS NORMAL WHEN FADEC POWER IS OFF)
  - No → USING MAINTENANCE TERMINAL, CHECK FOR EXISTENCE OF AMSolFit OR AMSwFit IN CURRENT OR LAST ENGINE RUN MEMORY

  - Do either of above fault codes exist?

    - Yes → PERFORM TASK 3 OR 19, AS APPROPRIATE
    - No → DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

  - IS CONNECTOR TIGHT?

    - Yes → TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE
    - No → ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

- AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

  - Yes → A (PG 2)
  - No → B (PG 2)

25 AUG 1998
36. **FADEC MANUAL WARNING (MFD) INCORRECTLY "ON"**

**A**

- **DEPENDING UPON FINDINGS:**
  - REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV
  - OR -

**B**

- **DISCONNECT CONNECTOR 1A6P2 AT ECU**
- **POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-9-10)**
- **CHECK FOR PRESENCE OF 28 VDC POWER AT SOCKET 25. MEASURE BETWEEN SOCKET AND GROUND STRAP. LIMIT 28 ± 1 VDC**

**C**

- **IS VOLTAGE WITHIN LIMITS?**
  - **TROUBLESHOOT AIRCRAFT 28 VDC SUPPLY PER TASK 17**
  - **YES**
    - **TROUBLESHOOT, REPAIR, OR REPLACE THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR MCPU, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV**
  - **NO**
    - **DEPPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)**
    - **RECONNECT ALL CONNECTORS**
    - **POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)**
    - **USING MAINTENANCE TERMINAL, MONITOR ManSel AND AutoSel PARAMETERS WHILE TOGGING AUTO/MANUAL SWITCH**
    - **PROPER OPERATION IS:**
      - **IF AUTO/MANUAL SWITCH IS SET TO AUTO:**
        - **AutoSel = ON**
        - **AND -**
        - **IF AUTO/MANUAL SWITCH IS SET TO MANUAL:**
          - **ManSel = ON**

**IS AUTO/MANUAL SWITCH OPERATION OK?**

**IS FADEC MANUAL WARNING DISPLAYED?**

**TROUBLESHOOT FADEC MODE SWICH CIRCUIT PER TASK 19 AND/OR SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV**

**USING MAINTENANCE TERMINAL, MONITOR ManSel AND AutoSel WHILE TOGGING WITH AUTO/MANUAL SWITCH**

**DOES MFD DISPLAY AGREE WITH SWITCH POSITION?**


*25 AUG 1998*
VERIFICATION PROCEDURE:

- Power up aircraft and control system (similar to TM 55-1520-248-23, task 9-3-10)
- Using maintenance terminal, monitor parameters ManSel and AutoSel.
- Select manual mode and verify that ManSel = ON and AutoSel = OFF, and that no current AMSolFit or AMSwFit fault codes exist.
- Select auto mode and verify that ManSel = OFF and AutoSel = ON, and that no current AMSolFit or AMSwFit fault codes exist.
- Repeat above verifications while running engine at ground idle, also verifying proper transition to, and operation in, each mode.

Perform any other required running checks or maintenance check flights normally associated with the repairs or parts changes accomplished.

Return to service.
37. FADEC MANUAL WARNING (MFD) INCORRECTLY "OFF"

DESCRIPTION:
A FADEC MANUAL WARNING IS NOT DISPLAYED ON MFD WHEN CONTROL IS OPERATING IN THE MANUAL MODE.

POSSIBLE CAUSES:
• FADEC MODE SWITCH FAILURE
• FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
• MATING CONNECTOR AT ECU LOOSE OR DAMAGED
• ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10) USING MAINTENANCE TERMINAL, CHECK FOR EXISTENCE OF AMSolFit OR AMSwFit FAULT CODES IN CURRENT MEMORY.

DO EITHER OF ABOVE FAULT CODES EXIST?

Yes →
PERFORM TASK 3 OR 19, AS APPROPRIATE

No →

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes →

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATEmg PLUG AND RECEPTACLE

B (PG 2)

No →

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECEssED OR MISSING?

Yes →

B (PG 2)

No →

DEPENDING UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE DISCRETE INDICATORS KEYBOARD UNIT (3041A0), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV


B (PG 2)

DISCONNECT CONNECTOR 1A6P2 AT ECU

• POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10) BUT LEAVE ECU CIRCUIT BREAKER 1CB15 OPEN (UNPOWERED)

IS FADEC MANUAL WARNING DISPLAYED ON MFD?

Yes →

TrouBleSHOOT, REPAIR, OR REPLACE THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3041A0), OR MCPU, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

B (PG 2)

No →

25 AUG 1998
37. FADEC MANUAL WARNING (MFD) INCORRECTLY "OFF"

**A**

- DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
- RECONNECT ALL CONNECTORS
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USING MAINTENANCE TERMINAL, MONITOR ManSel AND AutoSel PARAMETERS WHILE TOGGING AUTO/MANUAL SWITCH

**PROPER OPERATION IS:**
- IF AUTO/MANUAL SWITCH IS SET TO AUTO,
  - AutoSel = ON
- AND
- IF AUTO/MANUAL SWITCH IS SET TO MANUAL,
  - ManSel = ON

**IS AUTO/MANUAL SWITCH OPERATION OK?**
- Yes

**TROUBLESHOOT FADEC MODE SWITCH CIRCUIT PER TASK 19 AND/OR SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV**

**B**


**DOES MFD DISPLAY AGREE WITH SWITCH POSITION?**
- Yes
- No

**VERIFICATION PROCEDURE:**
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USING MAINTENANCE TERMINAL, MONITOR PARAMETERS ManSel AND AutoSel.
- SELECT MANUAL MODE AND VERIFY THAT ManSel = OFF AND AutoSel = ON, AND THAT NO CURRENT AMSfIFi OR AMSfIFi FAULT CODES EXIST.
- SELECT AUTO MODE AND VERIFY THAT ManSel = OFF AND AutoSel = ON, AND THAT NO CURRENT AMSfIFi OR AMSfIFi FAULT CODES EXIST.
- REPEAT ABOVE VERIFICATIONS WHILE RUNNING ENGINE AT GROUND IDLE, ALSO VERIFYING PROPER TRANSITION TO, AND OPERATION IN, EACH MODE.

**PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED**

**RETURN TO SERVICE**

25 AUG 1998
**ASSOCIATED FAULT INDICATION(S):**
- Ng2FII, Ng1CyFII, Ng1FII, Ng1RgFII,
- Ng1RIFII, Ng2CyFII, Ng2FII, Ng2RgFII,
- Ng2RIFII

**DESCRIPTION:**
The Ng Cockpit Gauge is inoperative or exhibits erratic behavior.

**POSSIBLE CAUSES:**
- Mating connectors on ECU, harnesses, or Ng sensor loose or damaged
- Ng sensor failure
- Harness failure
- Failure in Aircraft Ng indication system
- ECU failure

**PROCEED AS FOLLOWS TO RESOLVE:**

**POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15).**

**RESOLVE CONDITION IN ACCORDANCE WITH TM1-2840-263-23, CHAPTER 72-00-00, TABLE 101, AND RELATED SUPPLEMENTARY TROUBLESHOOTING SEQUENCES, AS WELL AS CHAPTER 73-21-00, PARA. 5.**

**VERIFY FAULTS AND ERROR CODES الدولة**
- Power up aircraft and control system (similar to TM 55-1520-248-23, Task 9-3-10).
- Using maintenance terminal, check current faults display after cycling FADEC power off and on (FADEC circuit breaker 1CB15).
- Perform any other required running checks or maintenance check flights normally associated with the repairs or parts changes accomplished.
- Return to service.
**39. \( N_p (N_2) \) COCKPIT GAUGE INOPERATIVE OR ERRATIC**

**ASSOCIATED FAULT INDICATION(S):**
- \( Np12FI \), \( Np1CyFI \), \( Np1FI \), \( Np1RgFI \), \( Np1RIFI \), \( Np2CyFI \), \( Np2FI \), \( Np2RgFI \), \( Np2RIFI \),

**DESCRIPTION:**

The \( N_p \) cockpit gauge is inoperative of exhibits erratic behavior

**POSSIBLE CAUSES:**
- Mating connectors on ECU, harnesses, or \( N_p \) sensor loose or damaged
- \( N_p \) sensor failure
- Harness failure
- Failure in aircraft \( N_p \) indication system
- ECU failure

Proceed as follows to resolve:

- **POWER UP AIRCRAFT AND CONTROL SYSTEM** (similar to TM 55-1520-248-23, Task 9-3-10).
  - Using maintenance terminal, check **CURRENT FAULTS** display after cycling FADEC power off and on (FADEC circuit breaker 1CB15)

**VERIFICATION PROCEDURE:**

- Power up aircraft and control system (similar to TM 55-1520-248-23, Task 9-3-10).
- Cycle FADEC power off and on (Circuit breaker 1CB15).
- Use maintenance terminal, with current faults display selected, to verify that no faults are present.
- Operate engine at 100% \( N_p \) with flat pitch rotor, and verify no \( N_p \) related faults appear.
- Verify proper cockpit dual tachometer \( N_p \) indication.

Perform any other required running checks or maintenance check flights normally associated with the repairs or parts changes accomplished.

**RETURN TO SERVICE**

**25 AUG 1998**
40. OVERSPEED TEST FAILS TO OPERATE

DESCRIPTION:
The overspeed test was activated but it did not shut the engine down

POSSIBLE CAUSES:
- Proper procedures not followed during overspeed test activation
- Errors in signals used in the overspeed test
- Test switch failure
- Mating connectors on ECU, HMU, or harnesses loose or damaged
- ECU failure

PROCEED AS FOLLOWS TO RESOLVE:

CONNECT MAINTENANCE TERMINAL AND CHECK CURRENT AND LAST ENGINE RUN MEMORY FOR FAULT CODES

ANY FAULTS DISPLAYED?
- No
  - PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE DISPLAYED FAULT CODES
  - C (PG 2)

OPERATE THE ENGINE AT CONDITIONS REQUIRED TO PERFORM THE OVERSPEED SHUTDOWN TEST, USING THE MAINTENANCE TERMINAL TO VERIFY THE SIGNALS MEET THE FOLLOWING CONDITIONS:
- \( Ng = 60\% - 66\% \)
- \( Np < 75\% \)
- \( PLA < 40^\circ \)
- \( CP < 10\% \)
- \( WNem > 65 \text{ PPH} \)
- \( NgDOT > -1 \%/\text{SEC} \)

ARE REQUIRED CONDITIONS MET?
- No
  - A (PG 2)
- Yes
  - PUSH AND THEN RELEASE THE OVERSPEED TEST BUTTON (ALLOWABLE TIME TO HOLD SWITCH ON IS 0.5 TO 10 SECONDS)

WITH MAINTENANCE TERMINAL, MONITOR \( OSTestSw \).
WHEN THE OVERSPEED TEST SWITCH IS PUSHED, EXPECTED RESULT IS:
\( OSTestSw = \text{ON} \)

DID ENGINE SHUT DOWN?
- No
  - C (PG 2)
- Yes
  - DOES \( OSTestSw = \text{ON} \)?
    - No
      - TROUBLESHOOT OVERSPEED TEST SWITCH CIRCUIT PER TASK 18
    - Yes
      - NO FURTHER ACTION REQUIRED. PROBLEM PROBABLY CAUSED BY IMPROPER PROCEDURE

26 AUG 1998
40. OVERSPEED TEST FAILS TO OPERATE

A

COCKPIT SIGNALS AGREE WITH MAINTENANCE TERMINAL?

PROBLEM IS PROCEDURAL. ADJUST TEST CONDITIONS TO AGREE WITH REQUIREMENTS

B

TROUBLESHOOT FAULTY PLA, CP, Ng, Np, OR Wf SIGNALS PER TASKS 6, 13, 8, 9, OR 5 AS APPLICABLE

CHECK MAINTENANCE TERMINAL FOR FAULT INDICATIONS

ANY FAULTS DISPLAYED?

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE DISPLAYED FAULT CODES


C

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- CONNECT MAINTENANCE TERMINAL WITH CURRENT FAULTS DISPLAY SELECTED
- OPERATE ENGINE AT GROUND IDLE AND TEST OVERSPEED SHUTDOWN SYSTEM
- REPEAT A SECOND TIME TO TEST THE ALTERNATE CHANNEL
- OBSERVE CURRENT FAULTS DISPLAY ON MAINTENANCE TERMINAL AFTER EACH OVERSPEED SHUTDOWN TEST TO VERIFY NO FAULTS INDICATED

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

26 AUG 1998
**41. ENGINE OUT WARNING (MFD) INCORRECTLY "ON"**

**DESCRIPTION:**
AN ENGINE OUT WARNING IS DISPLAYED ON MFD WHEN ENGINE IS RUNNING ABOVE 55% Ng

**POSSIBLE CAUSES:**
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE
- SIGNAL ERRORS

**PROCEED AS FOLLOWS TO RESOLVE:**

**DEPOWER AIRCRAFT** (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

**IS CONNECTOR TIGHT?**

- YES
  - DISCONNECT CONNECTOR 1A6P2 AT ECU
  - POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)
  - CONNECT A FREQUENCY GENERATOR TO SOCKETS 76 AND 77 OF CONNECTOR 1A6P2, TO SIMULATE AN Ng SIGNAL
  - SET THE FREQUENCY TO 10000 - 11000 Hz
  - CHECK MFD FOR ENGINE OUT WARNING

- NO
  - TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**A** (PG 2)

**B** (PG 2)

**IS ENGINE OUT WARNING DISPLAYED?**

- NO
  - TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

- YES
  - DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
  - RECONNECT ALL CONNECTORS
  - POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
  - CONNECT MAINTENANCE TERMINAL AND SET UP TO MONITOR T1, P1, Ng, AND NgDOT
  - OPERATE ENGINE AT 100% Ng, WITH ROTOR AT FLAT PITCH
  - VERIFY THAT T1 IS WITHIN ±10°F OF AMBIENT TEMPERATURE, P1 IS WITHIN ±1 PSI OF AMBIENT PRESSURE, Ng IS NOT ERRATIC, AND NgDOT IS WITHIN ±5 %/SEC

**B** (PG 2)

26 AUG 1998
41. **ENGINE OUT WARNING (MFD) INCORRECTLY "ON"**

---

**VERIFICATION PROCEDURE:**

- **Power up aircraft and control system (similar to TM 55-1520-248-23, task 9-3-10)**
- Verify **ENGINE OUT** warning is displayed on MFD
- Start engine to ground idle. Verify **ENGINE OUT** warning is no longer displayed above 55% Ng
- Move throttle to cutoff position and verify that **ENGINE OUT** warning is displayed immediately upon cutting throttle

---

**PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECKS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED**

RETURN TO SERVICE
42. **ENGINE OUT WARNING (MFD) INCORRECTLY "OFF"**

**DESCRIPTION:**
AN ENGINE OUT WARNING IS NOT DISPLAYED ON MFD WHEN ENGINE IS SHUT DOWN OR RUNNING BELOW 55% Ng

**POSSIBLE CAUSES:**
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
- BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.
- IS CONNECTOR TIGHT?
  - **Yes**
  - TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE
  - **A (PG 2)**
  - DISCONNECT CONNECTOR 1A6P2 AT ECU
  - POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1C615 PULLED)
  - CONNECT A JUMPER FROM SOCKET 18 TO GROUND AT ECU GROUNDING STRAP
  - CHECK MFD FOR ENGINE OUT WARNING
  - **A (PG 2)**
  - **A (PG 2)**

- **No**
- ARE PINS OR SOCKETS SERT, RECESSD OR MISSING?
  - **Yes**
  - DEPENDING UPON FINDINGS:
  - REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV
  - OR -

- **No**
- IS ENGINE OUT WARNING DISPLAYED?
  - **Yes**
  - TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

---

**A (PG 2)**

**A (PG 2)**

**26 AUG 1998**
42. **ENGINE OUT WARNING (MFD) INCORRECTLY "OFF"**

**VERIFICATION PROCEDURE:**

- Power up aircraft and control system (similar to TM 55-1520-248-23, Task 9-3-10)
- Verify **ENGINE OUT** warning is displayed on MFD
- Start engine to ground idle, verify **ENGINE OUT** warning is no longer displayed above 55% N₉
- Move throttle to cutoff position and verify that **ENGINE OUT** warning is displayed immediately upon cutting throttle

**PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED**

**RETURN TO SERVICE**
DESCRIPTION:
A FADEC MAINT ADVISORY IS DISPLAYED ON MFD BUT NO CURRENT OR LAST ENGINE RUN FAULTS ARE INDICATED.

POSSIBLE CAUSES:
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

DEPENDING UPON FINDINGS:
- REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

B (PG 2)

B (PG 2)

ARE ANY FAULT CODES INDICATED?

Yes

MFD FADEC MAINT ADVISORY IS CORRECT.
PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE INDICATED FAULT CODES

No

IS FADEC MAINT ADVISORY DISPLAYED?

Yes

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

B (PG 2)

No


A (PG 2)

01 SEP 1998
43. **FADEC MAINT. ADVISORY (MFD) INCORRECTLY "ON"**

![Diagram]

**TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A9), OR THE MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)**

**VERIFICATION PROCEDURE:**
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (BREAKER 1CB15)
- SET THROTTLE TO GROUND IDLE
- CONNECT MAINTENANCE TERMINAL AND VERIFY NO CURRENT FAULTS SHOWING
- VERIFY FADEC MAINT ADVISORY IS NOT DISPLAYED ON MFD
- DISCONNECT COLLECTIVE PITCH POTentiOMETER CONNECTOR (1MT10J1) TO CREATE A FAULT
- VERIFY THAT FADEC MAINT ADVISORY IS DISPLAYED ON MFD
- RECONNECT COLLECTIVE PITCH POTentiOMETER CONNECTOR
- CYCLE FADEC POWER OFF AND ON (BREAKER 1CB15), AND VERIFY FADEC MAINT ADVISORY IS NOT DISPLAYED

**PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED**

**RETURN TO SERVICE**

01 SEP 1998
44. FADEC MAINT. ADVISORY (MFD) INCORRECTLY "OFF"

DESCRIPTION:
A FADEC MAINT ADVISORY IS NOT DISPLAYED ON MFD ALTHOUGH CURRENT OR LAST ENGINE RUN FAULTS ARE INDICATED

POSSIBLE CAUSES:
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCP US
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- PLACE THROTTLE IN CUTOFF POSITION.
- USING MAINTENANCE TERMINAL, CHECK CURRENT FAULTS AND LAST ENGINE RUN FAULTS DISPLAYS AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

ARE ANY FAULT CODES INDICATED?
- Yes
  - ABSENCE OF AN MFD FADEC MAINT ADVISORY IS CORRECT.
  - DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
  - BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.
  - IS CONNECTOR TIGHT?
    - Yes
      - B (PG 2)
    - No
      - TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE
      - B (PG 2)

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?
- Yes
  - A (PG 2)
  - IS FADEC MAINT ADVISORY DISPLAYED?
    - Yes
    - B (PG 2)
    - No

- No
  - DISCONNECT CONNECTOR 1A6P2 AT ECU
  - POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)
  - CONNECT A JUMPER TO SOCKET 14 TO GROUND AT ECU GROUNDING STRAP
  - CHECK MFD FOR FADEC MAINT ADVISORY DISPLAY

01 SEP 1998
44. **FADEC MAINT. ADVISORY (MFD) INCORRECTLY "OFF"**

---

**A**

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

---

**B**

- DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
- RECONNECT ALL CONNECTORS
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CONNECT MAINTENANCE TERMINAL AND SET UP TO VIEW CURRENT AND LAST ENGINE RUN FAULTS
- PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE INDICATED FAULT CODES

---

**C**

**VERIFICATION PROCEDURE:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (BREAKER 1CB15)
- SET THROTTLE TO GROUND IDLE
- CONNECT MAINTENANCE TERMINAL AND VERIFY NO CURRENT FAULTS SHOWING
- VERIFY FADEC MAINT ADVISORY IS NOT DISPLAYED ON MFD
- DISCONNECT COLLECTIVE PITCH POTENTIOMETER CONNECTOR (1MT10J1) TO CREATE A FAULT
- VERIFY THAT FADEC MAINT ADVISORY IS DISPLAYED ON MFD
- RECONNECT COLLECTIVE PITCH POTENTIOMETER CONNECTOR
- CYCLE FADEC POWER OFF AND ON (BREAKER 1CB15), AND VERIFY FADEC MAINT ADVISORY IS NOT DISPLAYED

---

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

---

RETURN TO SERVICE

---

01 SEP 1999
ASSOCIATED FAULT INDICATION(S):
AD12BFIT, AD0BFIT, AMSolFIT, AMSSwFIT, ECOUTFIT, GainFIT, HLRIFIT, Ng12FIT, Np12FIT, OffsFIT, P1HdFIT, PLAhdFIT, PROMFIT, PW10FIT, RAMFIT, SmFIT, StepCntFIT, T1ABAFIT, V15FIT, V5FIT, WDITimeOut, WHdFIT, WISIFIT

DESCRIPTION:
The control system is operating fail-fixed but there is no FADEC fail warning on MFD.

POSSIBLE CAUSES:
- 28 VDC supply to ECU is low
- HMU failure
- ECU failure

PROCEED AS FOLLOWS TO RESOLVE:

THIS CONDITION CAN OCCUR DURING OPERATION BELOW 85% Np WITH ECU POWER TURNED OFF (BREAKER 1CB15 OPEN)

WAS THIS THE CONDITION WHEN EVENT OCCURRED?

WAS OPERATION ABOVE 85% Np WITH ECU POWER OFF?

CONNECT MAINTENANCE TERMINAL AND CHECK CURRENT AND LAST ENGINE RUN FAULT DISPLAYS FOR HARD FAULTS (LISTED ABOVE AS ASSOCIATED FAULT INDICATIONS)

SYSTEM FUNCTION IS SATISFACTORY. EVENT WAS CAUSED BY ABNORMAL OPERATING CONDITION.

ANY HARD FAULTS DISPLAYED?

DID EVENT OCCUR BELOW 85% Np WITH ECU POWER ON?

CHECK BOTH AIRCRAFT 28 VDC POWER SUPPLY AND PMA CIRCUIT (PER TASKS 17 AND 11, RESPECTIVELY)

WERE PROBLEMS DETECTED?


PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE INDICATED FAULT CODES
- IF THE HARD FAULTS HAVE NOT RESULTED IN A FADEC FAIL WARNING ON THE MFD, TROUBLESHOOT PER TASK 35

CHECK THE AIRCRAFT 28 VDC POWER SUPPLY SYSTEM PER TASK 17

IS AIRCRAFT 28 VDC POWER SUPPLY OK?

TROUBLESHOOT THE AIRCRAFT 28 VDC POWER SUPPLY SYSTEM PER TASK 17

TROUBLESHOOT THE AIRCRAFT 28 VDC POWER SUPPLY OR THE PMA CIRCUIT (PER TASKS 17 OR 11, AS APPLICABLE)

27 AUG 1998
45. FADEC FAILS FIXED WITH NO MFD FADEC FAIL WARNING

A

CHECK THE PMA CIRCUIT PER TASKS 11

WERE PROBLEMS DETECTED?

TROUBLESHOOT THE AIRCRAFT 28VDC POWER SUPPLY OR THE PMA CIRCUIT (PER TASKS 17 OR 11, AS APPLICABLE)


B

HAS HMU BEEN REPLACED IN THIS SEQUENCE?

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-240-23, TASK 9-3-10), WITH FADEC IN AUTO MODE
- DISCONNECT Ng SENSOR TO CREATE A HARD FAULT AND VERIFY FADEC FAIL WARNING ON MFD
- RECONNECT Ng SENSOR AND CYCLE FADEC POWER OFF AND ON (BREAKER 1CB15) TO CLEAR FAULT
- RUN ENGINE AT 86% Np AND TURN OFF ECU POWER (PULL BREAKER 1CB15)
- VERIFY FAIL-FIXED CONDITION DOES NOT RECUR
- RESTORE POWER TO ECU AND COMPLETE NORMAL SHUTDOWN

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

27 AUG 1998
46. MANUAL MODE OPERATIONAL PROBLEM

DESCRIPTION:
THE ENGINE IS OPERATING IN MANUAL MODE, BUT MANUAL MODE IS NOT OPERATING PROPERLY

POSSIBLE CAUSES:
• HMU FAILURE
• FUEL SYSTEM COMPONENT FAILURE
• THROTTLE RIGGING PROBLEM
• AIRCRAFT POWER SUPPLY FAILURE
• ECU POWER SUPPLY FAILURE
• FUEL SYSTEM CONTAMINATION

PROCEED AS FOLLOWS TO RESOLVE:

CONNECT MAINTENANCE TERMINAL AND CHECK CURRENT AND LAST ENGINE RUN FAULT DISPLAYS

ARE ANY FAULT CODES DISPLAYED?
No
Yes

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE INDICATED FAULT CODES

CHECK RIGGING OF HMU THROTTLE LEVER TO TWIST GRIP PER TM 1-2840-263-23, CHAPTER 73-21-01, PARA. 1.D.

WAS RIGGING OK?
Yes
No

ADJUST RIGGING OF HMU THROTTLE LEVER TO TWIST GRIP PER TM 1-2840-263-23, CHAPTER 73-21-01, PARA. 1.D.

C
(PG 2)

DEPOWER AIRCRAFT
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
• DISCONNECT CONNECTOR 1A6P2 AT ECU
• POWER UP AIRCRAFT AND CONTROL SYSTEM ON SHIP'S BATTERY
• CHECK FOR PRESENCE OF 28 VDC POWER AT SOCKET 25. MEASURE BETWEEN SOCKET AND GROUND STRAP.
LIMIT 28 ± 1 VDC

DEPOWER ECU (PULL BREAKER 1CB15)
• RECONNECT CONNECTOR 1A6P2 AT ECU
• DISCONNECT CONNECTOR P4 AT HMU
• POWER UP ECU (BREAKER 1CB15) ON SHIP'S BATTERY
• SELECT MANUAL MODE
• CHECK FOR PRESENCE OF 28 VDC POWER BETWEEN SOCKETS R & S. (THIS POWERS THE HOT START ABORT SOLENOID)

LIMIT 28 ± 1 VDC

IS VOLTAGE WITHIN LIMITS?
Yes
No

A
(PG 2)

HAS ECU BEEN REPLACED IN THIS SEQUENCE?
Yes
No

B
(PG 2)


C
(PG 2)

IS VOLTAGE WITHIN LIMITS?
Yes
No

TROUBLESHOOT THE AIRCRAFT 28 VDC POWER SUPPLY SYSTEM PER TASK 17

27 AUG 1998
46. MANUAL MODE OPERATIONAL PROBLEM

A

• INSPECT AIRCRAFT FUEL SYSTEM FOR EVIDENCE OF EXCESSIVE WATER IN FUEL, USING NORMAL TANK SAMPLING PROCEDURE.
• INSPECT ENGINE FUEL FILTER IMPENDING BYPASS POP-OUT INDICATOR AND, IF EXTENDED, INSPECT FILTER ELEMENT FOR CONTAMINATION IAW TM1-2840-263-23, SECTION 73-10-01, PARA. 2.A.

EVIDENCE OF FUEL CONTAMINATION?

No

Yes

• DEFUEL, FLUSH, AND REFUEL AIRCRAFT FUEL SYSTEM SIMILAR TO AIRCRAFT MAINTENANCE MANUAL TM 55-1520-248-23, TASKS 1-4-3 AND 1-4-2
• CLEAN ENGINE FUEL FILTER ASSEMBLY AND REPLACE ELEMENT PER TM1-2840-263-23, SECTION 73-10-01, PARA. 2.B AND 2.C.
• PURGE HMU PER TM1-2840-263-23, SECTION 73-00-00, PARA. 1.B.

B

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

TROUBLESHOOT HOT START ABORT SOLENOID CIRCUIT PER TASK 2

B

C

VERIFICATION PROCEDURE:

• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), WITH FADEC IN AUTO MODE
• CONNECT MAINTENANCE TERMINAL AND VERIFY NO CURRENT FAULTS DISPLAYED
• OPERATE ENGINE AT GROUND IDLE AND SELECT MANUAL MODE
• INCREASE SPEED TO 100% NO WITH FLAT ROTOR PITCH AND VERIFY FREEDOM FROM FAULTS AND SATISFACTORY OPERATION IN BOTH MANUAL AND AUTO MODES
• PERFORM POWER AVAILABILITY CHECKS IN BOTH CONTROL MODES

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

27 AUG 1998
DESCRIPTION:
THE MAINTENANCE TERMINAL (MT) DOES NOT COMMUNICATE WITH THE ECU ("NO ECU AVAILABLE" OR OTHER COMMUNICATION FAILURE MESSAGE DISPLAYED ON SCREEN OF MAINTENANCE TERMINAL)

POSSIBLE CAUSES:
- ECU NOT POWERED
- MAINTENANCE TERMINAL CABLE FAILURE
- PROBLEM WITH MAINTENANCE TERMINAL SET-UP, SOFTWARE FILES, OR COMPATIBILITY
- ECU CONFIGURATION INCORRECT
- MATING CONNECTORS ON ECU, MAINTENANCE TERMINAL, OR HARNESS LOOSE OR DAMAGED
- AIRCRAFT HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

CHECK THAT ECU IS POWERED UP (AIRCRAFT POWERED AND BREAKER 1C615 CLOSED), AND THAT MAINTENANCE TERMINAL IS PROPERLY CONNECTED TO AIRCRAFT CONNECTOR 1J12. TRY AGAIN TO ESTABLISH COMMUNICATION

ARE MT HARDWARE & SOFTWARE COMPATIBLE WITH ECU VERSION?
- Yes
- No

LOAD CORRECT FILES FROM KNOWN SOURCE INTO MT, OR USE A DIFFERENT MT KNOWN TO BE SATISFACTORY

USE A DIFFERENT MT KNOWN TO BE SATISFACTORY

ABLE TO COMMUNICATE WITH ECU?
- Yes
- No

DEPENDING UPON FINDINGS:
- REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE MAINTENANCE TERMINAL, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV
- OR - REPLACE THE MAINTENANCE TERMINAL CABLE

DEPOWER AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11), AND TURN OFF MAINTENANCE TERMINAL

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?
- Yes
- No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?
- Yes
- No

A (PG 2)

B (PG 2)

B (PG 2)

27 AUG 1998
47. MAINTENANCE TERMINAL COMMUNICATION FAULT

A

CHECK CONTINUITY OF EACH ACTIVE WIRE OF THE MAINTENANCE TERMINAL CABLE, FROM THE COMPUTER END TO THE AIRCRAFT CONNECTOR END

SOCKET PIN LIMITS (Ω)
2 2 <1
3 4 <1
5 3 <1
5 5 <1

PIN-TO-GROUND >1 MEGOHM

DO RESISTANCE VALUE MEET LIMITS?
Yes

REPLACE MAINTENANCE TERMINAL CABLE

DO RESISTANCE VALUE MEET LIMITS?
No

REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND (AMONG OTHER THINGS) TO THE MAINTENANCE TERMINAL, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

B

VERIFICATION PROCEDURE:
- VERIFY THAT MAINTENANCE TERMINAL MAIN MENU Initializes WITH THE ECU SOFTWARE VERSION NUMBER ON THE DISPLAY

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

HAS ECU ALREADY BEEN REPLACED IN THIS SEQUENCE?
Yes

REINSTALL ORIGINAL ECU AND FURTHER TROUBLESHOOT THE MAINTENANCE TERMINAL


27 AUG 1998
A FADEC DEGRADE - DROOP MESSAGE (MFD) INCORRECTLY "ON"

**DESCRIPTION:**
A FADEC DEGRADE - DROOP MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

**POSSIBLE CAUSES:**
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

**DESCRIPTION:**
USING MAINTENANCE TERMINAL, CHECK CURRENT AND LAST ENGINE RUN FAULTS DISPLAY

**DESCRIPTION:**
PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES

**DESCRIPTION:**
DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**DESCRIPTION:**
BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

**DESCRIPTION:**
IS CONNECTOR TIGHT?

**DESCRIPTION:**

**DESCRIPTION:**
AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

**DESCRIPTION:**
ARE PINS OR SOCKETS BENT, RECESS OR MISSING?

**DESCRIPTION:**
DISCONNECT CONNECTOR 16P2 AT ECU

**DESCRIPTION:**
POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

**DESCRIPTION:**
IS FADEC MAINT ADVISORY DISPLAYED?

**DESCRIPTION:**
PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION

**DESCRIPTION:**
TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

**DESCRIPTION:**
IS FADEC MAINT ADVISORY DISPLAYED?

**DESCRIPTION:**
TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**DESCRIPTION:**
C (PG 2)

**DESCRIPTION:**
A (PG 2)

**DESCRIPTION:**
B (PG 2)

**DESCRIPTION:**
01 SEP 1998
48. **FADEC DEGRADE - DROOP MESSAGE (MFD) INCORRECTLY "ON"**

A

**DEPENDING UPON FINDINGS:**
- OR -

B


C

**VERIFICATION PROCEDURE:**
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN GROUND IDLE POSITION
- VERIFY **FADEC DEGRADE - DROOP** NOT DISPLAYED ON MFD FADEC MONITOR PAGE AND **FADEC MAINT** NOT DISPLAYED ON MFD INITIAL PAGE 1
- USING MAINTENANCE TERMINAL VERIFY **NO CURRENT FAULTS**
- DISCONNECT COLLECTIVE PITCH POTentiOMETER CONNECTOR 1MT10J1 TO CREATE A DROOP-RELATED FAULT
- VERIFY **FADEC DEGRADE - DROOP** IS NOW DISPLAYED ON MFD FADEC MONITOR PAGE AND **FADEC MAINT** DISPLAYED ON MFD INITIAL PAGE 1
- RECONNECT COLLECTIVE PITCH POTentiOMETER CONNECTOR AND CYCLE ECU POWER OFF AND ON (BREAKER 1CB15) TO CLEAR FAULT
- VERIFY **FADEC DEGRADE - DROOP AND FADEC MAINT** MESSAGES NO LONGER DISPLAYED

**PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED**

**RETURN TO SERVICE**

01 SEP 1998
49. **FADEC DEGRADE - DROOP MESSAGE (MFD) INCORRECTLY "OFF"**

**ASSOCIATED FAULT INDICATION(S):**

- CPFit, P1Fit, PLA12Fit, PLARIFit, SgFlag, StSFit, StISFit, WILimFlg

**DESCRIPTION:**

A FADEC DEGRADE - DROOP MESSAGE IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE WHEN ASSOCIATED FAULTS ARE ACTIVE

**POSSIBLE CAUSES:**

- Failure of aircraft harness from ECU to discrete indicators keyboard unit, keyboard unit itself, or left MCPU
- Mating connector at ECU loose or damaged
- ECU failure

**PROCEED AS FOLLOWS TO RESOLVE:**

- Power up aircraft and control system (similar to TM 55-1520-248-23, Task 9-3-10)
- Place throttle twist grip in cutoff position
- Check whether FADEC maint advisory is displayed on MFD
- Using maintenance terminal, check current and last engine run faults displays

- Disconnect connector 1A6P2 at ECU
- Power up aircraft (similar to TM 55-1520-248-23, Task 9-3-10), but leave ECU power off (circuit breaker 1CB15 pulled)
- Connect a jumper from socket 14 to ground at ECU grounding strap
- Check MFD for FADEC MAINT advisory

- Troubleshoot the aircraft wiring harness, the discrete indicators keyboard unit (3431A2), or the left MCPU (similar to TM 55-1520-248-23, Appendix K, Section IV)

---

**B (PG 2)**

**ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?**

- Yes
- No

**A (PG 2)**

**IS FADEC MAINT ADVISORY DISPLAYED?**

- Yes
- No

---

**C (PG 2)**

**IS CONNECTOR TIGHT?**

- Yes
- No

**TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE**

---

**C (PG 2)**

---

02 SEP 1998
49. FADEC DEGRADE - DROOP MESSAGE (MFD)
INCORRECTLY "OFF"

A

WAS IT DISPLAYED INITIALLY, BEFORE DISCONNECTING?

Yes

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

No


B

DEPENDING UPON FINDINGS:
REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), AND THE LEFT MCPU (3431A1) SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

- OR -


C

RECONNECT ALL CONNECTORS
POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
CONNECT MAINTENANCE TERMINAL AND SET UP TO VIEW CURRENT AND LAST ENGINE RUN FAULTS
PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE INDICATED FAULT CODES

VERIFICATION PROCEDURE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN GROUND IDLE POSITION
- VERIFY FADEC DEGRADE - DROOP NOT DISPLAYED ON MFD FADEC MONITOR PAGE AND FADEC MAINT NOT DISPLAYED ON MFD INITIAL PAGE 1
- USING MAINTENANCE TERMINAL VERIFY NO CURRENT FAULTS
- DISCONNECT COLLECTIVE PITCH POTENTIOMETER CONNECTOR 1MT10J1 TO CREATE A DROOP-RELATED FAULT
- VERIFY FADEC DEGRADE - DROOP IS NOW DISPLAYED ON MFD FADEC MONITOR PAGE AND FADEC MAINT DISPLAYED ON MFD INITIAL PAGE 1
- RECONNECT COLLECTIVE PITCH POTENTIOMETER CONNECTOR AND CYCLE ECU POWER OFF AND ON (BREAKER 1CB15) TO CLEAR FAULT
- VERIFY FADEC DEGRADE - DROOP AND FADEC MAINT MESSAGES NO LONGER DISPLAYED AND NO CURRENT FAULTS ACTIVE

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

02 SEP 1998
50. **FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD) INCORRECTLY "ON"**

**ASSOCIATED FAULT INDICATION(S):**
OSVF1, OSF11

**DESCRIPTION:**
A FADEC DEGRADE - OS (OVERSPEED) MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

**POSSIBLE CAUSES:**
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

**PROCEED AS FOLLOWS TO RESOLVE:**

1. PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION
2. IS FADEC MAINT ADVISORY DISPLAYED?
   - Yes
   - No
4. USING MAINTENANCE TERMINAL, CHECK CURRENT AND LAST ENGINE RUN FAULTS DISPLAY
5. ANY FAULTS DISPLAYED?
   - Yes
   - No
6. PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES
7. DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
8. BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.
9. IS CONNECTOR TIGHT?
   - Yes
   - No
10. IS FADEC MAINT ADVISORY DISPLAYED?
    - Yes
    - No
12. TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS**

13. ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?
    - Yes
    - No
14. DISCONNECT CONNECTOR 1A6P2 AT ECU
    - POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

**01 SEP 1998**
50. **FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD) INCORRECTLY "ON"**

**A**

**DEPENDING UPON FINDINGS:**
- OR

**B**


**C**

**VERIFICATION PROCEDURE:**
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN GROUND IDLE POSITION
- VERIFY **FADEC DEGRADE - OS NOT DISPLAYED ON MFD FADEC MONITOR PAGE AND FADEC MAINT NOT DISPLAYED ON MFD INITIAL PAGE 1**
- USING MAINTENANCE TERMINAL VERIFY NO CURRENT FAULTS
- DISCONNECT HMU CONNECTOR P4 TO CREATE AN OVERSPEED SYSTEM-RELATED FAULT
- VERIFY **FADEC DEGRADE - OS IS NOW DISPLAYED ON MFD FADEC MONITOR PAGE AND FADEC MAINT DISPLAYED ON MFD INITIAL PAGE 1**
- RECONNECT HMU CONNECTOR AND CYCLE ECU POWER OFF AND ON (BREAKER 1CB15) TO CLEAR FAULT
- VERIFY **FADEC DEGRADE - OS AND FADEC MAINT MESSAGES NO LONGER DISPLAYED**

**PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED**

**RETURN TO SERVICE**

**01 SEP 1998**
51. FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD)

INCORRECTLY "OFF"

A FADEC DEGRADE - OS (OVERSPEED) MESSAGE IS NOT DISPLAYED ON MFD WHEN ASSOCIATED FAULTS ARE ACTIVE.

DESCRIPTION:

- Failure of Aircraft Harness from ECU to Discrete Indicators.
- Mating connector at ECU or WIRING LOOSENESS.
- Mating connector at ECU.

POSSIBLE CAUSES:

- Mating connector at ECU.
- Mating connector at ECU.
- Mating connector at ECU.

PROCEDURE:

- Check Mating connector at ECU.
- Check Mating connector at ECU.
- Check Mating connector at ECU.

ASSOCIATED FAULT INDICATIONS:

OSWIR OR SFH

REFERENCE:


Page 1 of 2
52. **FADEC DEGRADE - ARINC MESSAGE (MFD) INCORRECTLY "ON"**

**ASSOCIATED FAULT INDICATION(S):**
ARINCWFII

**DESCRIPTION:**
A FADEC DEGRADE - ARINC MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

**POSSIBLE CAUSES:**
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

1. **PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION**

2. **IS FADEC MAINT ADVISORY DISPLAYED?**
   - **Yes**
     - TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)
   - **No**

3. IS CONNECTOR TIGHT?
   - **Yes**
     - C (PG 2)
   - **No**

4. **TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE**

5. **USING MAINTENANCE TERMINAL, CHECK CURRENT AND LAST ENGINE RUN FAULTS DISPLAY**

6. **ANY FAULTS DISPLAYED?**
   - **No**
     - **C (PG 2)**
   - **Yes**
     - **PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES**

7. **DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)**

8. **BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.**

9. **ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?**
   - **Yes**
     - **A (PG 2)**
   - **No**

10. **DISCONNECT CONNECTOR 160P2 AT ECU**
    - **SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)**

11. **IS FADEC MAINT ADVISORY DISPLAYED?**
    - **Yes**
    - **No**
52. **FADEC DEGRADE - ARINC MESSAGE (MFD) INCORRECTLY "ON"**

**A**

**DEPENDING UPON FINDINGS:**
- OR -

**B**


**C**

**VERIFICATION PROCEDURE:**
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- PLACE THROTTLE TWIST GRIP IN GROUND IDLE POSITION.
- VERIFY **FADEC DEGRADE - ARINC** NOT DISPLAYED ON MFD FADEC MONITOR PAGE AND **FADEC MAINT** NOT DISPLAYED ON MFD INITIAL PAGE 1.
- USE MAINTENANCE TERMINAL TO VERIFY NO CURRENT FAULTS.
- START ENGINE AND OPERATE AT 100% Np. WITH ROTOR IN FLAT PITCH. VERIFY **FADEC DEGRADE - ARINC** NOT DISPLAYED ON MFD FADEC MONITOR PAGE AND **FADEC MAINT** NOT DISPLAYED ON MFD INITIAL PAGE 1.
- SHUT DOWN AND VERIFY NO CURRENT FAULTS OR DEGRADE MESSAGES.

**PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED.**

**RETURN TO SERVICE**

**31 AUG 1999**
ASSOCIATED FAULT INDICATION(S):
ARINCWFDFII

DESCRIPTION:
A FADEC DEGRADE - ARINC MESSAGE IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE WHEN ASSOCIATED FAULT IS ACTIVE

POSSIBLE CAUSES:
• FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
• MATING CONNECTOR AT ECU LOOSE OR DAMAGED
• ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

DISCONNECT CONNECTOR 1A6P2 AT ECU
• POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 10C15 PULLED)
• CONNECT A JUMPER FROM SOCKET 14 TO GROUND AT ECU GROUNDING STRAP
• CHECK MFD FOR FADEC MAINT ADVISORY

IS FADEC MAINT ADVISORY DISPLAYED?

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

02 SEP 1998
53. **FADEC DEGRADE - ARINC MESSAGE (MFD) INCORRECTLY "OFF"**

**A**
- WAS IT DISPLAYED INITIALLY BEFORE DISCONNECTING?
  - **Yes**
  - **No**
    - **B**
      - **DEPENDING UPON FINDINGS:**

**B**
- **VERIFICATION PROCEDURE:**
  - **POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)**
  - **PLACE THROTTLE TWIST GRIP IN GROUND IDLE POSITION**
  - **VERIFY FADEC DEGRADE - ARINC NOT DISPLAYED ON MFD FADEC MONITOR PAGE AND FADEC MAINT NOT DISPLAYED ON MFD INITIAL PAGE 1**
  - **DISCONNECT COLLECTIVE PITCH POTENTIOMETER CONNECTOR (1MT10J1) TO PROVOKE A FAULT**
  - **VERIFY ARINC BUS FUNCTIONAL BY READING 2ND CHARACTER (FROM LEFT) OF ESWI -- SHOULD BE 4 (BUT IF SOME OTHER LAST ENGINE RUN FAULTS ARE STILL PRESENT, IT IS ACCEPTABLE IF THE CHARACTER IS 5, 6, 7, C, D, E, OR F)**
  - **ALSO VERIFY FADEC DEGRADE - DROP IS NOW DISPLAYED ON MFD FADEC MONITOR PAGE BUT FADEC DEGRADE - ARINC IS NOT**
  - **RECONNECT COLLECTIVE PITCH POTENTIOMETER CONNECTOR AND CYCLE ECU POWER OFF AND ON (BREAKER 1CB15) TO CLEAR FAULT**
  - **START ENGINE AND OPERATE AT 100% Np, WITH ROTOR IN FLAT PITCH. VERIFY NO CURRENT FAULTS SHOWING ON MAINTENANCE TERMINAL**
  - **SHUT DOWN AND VERIFY NO CURRENT FAULTS, NO DEGRADE MESSAGES, AND ALL ESWs INDICATING NOTHING BUT ZEROS**

**C**
- **RECONNECT ALL CONNECTORS**
- **POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)**
- **CONNECT MAINTENANCE TERMINAL AND SET UP TO VIEW CURRENT AND LAST ENGINE RUN FAULTS**
- **PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE INDICATED FAULT CODES**
- **PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED**
- **RETURN TO SERVICE**

02 SEP 1998

REV. 12 JUL 99
54. FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD) INCORRECTLY "ON"

ASSOCIATED FAULT INDICATION(S):
QF1

DESCRIPTION:
A FADEC DEGRADE - TRQ LIM LOSS (TORQUE LIMITER LOSS) MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

POSSIBLE CAUSES:
* FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
* MATING CONNECTOR AT ECU LOOSE OR DAMAGED
* ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION

IS FADEC MAINT ADVISORY DISPLAYED?

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

USING MAINTENANCE TERMINAL, CHECK CURRENT AND LAST ENGINE RUN FAUL TS DISPLAY

ANY FAULTS DISPLAYED?

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C (PG 2)

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

DISCONNECT CONNECTOR 1A8P2 AT ECU
* POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

IS FADEC MAINT ADVISORY DISPLAYED?


B (PG 2)

01 SEP 1998
54. FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD) INCORRECTLY "ON"

**A**

DEPENDING UPON FINDINGS:
- OR-

**B**

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

**C**

VERIFICATION PROCEDURE:
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN GROUND IDLE POSITION
- VERIFY FADEC DEGRADE - TRQ LIM LOSS NOT DISPLAYED ON MFD FADEC MONITOR PAGE AND FADEC MAINT NOT DISPLAYED ON MFD INITIAL PAGE 1
- USE MAINTENANCE TERMINAL TO VERIFY NO CURRENT FAULTS
- DISCONNECT TORQUE METER OIL PRESSURE SENSOR CONNECTOR P10 TO CREATE A TORQUE-RELATED FAULT
- START ENGINE AND OPERATE AT 100% Np, WITH ROTOR IN FLAT PITCH
- VERIFY FADEC DEGRADE - TRQ LIM LOSS IS DISPLAYED ON MFD FADEC MONITOR PAGE
- SHUT DOWN ENGINE AND RECONNECT TMOP SENSOR CONNECTOR
- CYCLE FADEC POWER OFF AND ON (BREAKER 1CB15)
- START ENGINE AND OPERATE AT 100% Np, WITH ROTOR IN FLAT PITCH
- VERIFY FADEC DEGRADE - TRQ LIM LOSS IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE
- SHUT DOWN AND VERIFY NO CURRENT FAULTS OR DEGRADE MESSAGES ARE DISPLAYED

RETURN TO SERVICE

01 SEP 1998
ASSOCIATED FAULT INDICATION(S):
QFII

DESCRIPTION:
A FADEC DEGRADE - TRQ LIM LOSS (TORQUE LIMITER LOSS) MESSAGE IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE WHEN ASSOCIATED FAULT IS ACTIVE

POSSIBLE CAUSES:
• FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
• MATING CONNECTOR AT ECU LOOSE OR DAMAGED
• ECU FAILURE

PROCEDURE AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

NO

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

YES

DISCONNECT CONNECTOR 1A6P2 AT ECU
• POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)
• CONNECT A JUMPER FROM SOCKET 14 TO GROUND AT ECU GROUNDING STRAP
• CHECK MFD FOR FADEC MAINT ADVISORY

IS FADEC MAINT ADVISORY DISPLAYED?

YES

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

C (PG 2)

02 SEP 1998
55. **FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD) INCORRECTLY "OFF"**

**A**

**WAS IT DISPLAYED INITIALLY, BEFORE DISCONNECTION?**

- **Yes**
  - TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

- **No**

**B**


**C**

- RECONNECT ALL CONNECTORS
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CONNECT MAINTENANCE TERMINAL AND SET UP TO VIEW CURRENT AND LAST ENGINE RUN FAULTS
- PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH THE INDICATED FAULT CODES

**VERIFICATION PROCEDURE:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN GROUND IDLE POSITION
- VERIFY FADEC DEGRADE - TRQ LIM LOSS NOT DISPLAYED ON MFD FADEC MONITOR PAGE AND FADEC MAINT NOT DISPLAYED ON MFD INITIAL PAGE 1
- USE MAINTENANCE TERMINAL TO VERIFY NO CURRENT FAULTS
- DISCONNECT TORQUEMETER OIL PRESSURE SENSOR CONNECTOR P10 TO CREATE A TORQUE-RELATED FAULT
- START ENGINE AND OPERATE AT 100% Np, WITH ROTOR IN FLAT PITCH
- VERIFY FADEC DEGRADE - TRQ LIM LOSS IS DISPLAYED ON MFD FADEC MONITOR PAGE
- SHUT DOWN ENGINE AND RECONNECT TMOP SENSOR CONNECTOR
- CYCLE FADEC POWER OFF AND ON (BREAKER 1CB15)
- START ENGINE AND OPERATE AT 100% Np, WITH ROTOR IN FLAT PITCH
- VERIFY FADEC DEGRADE - TRQ LIM LOSS IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE
- SHUT DOWN AND VERIFY NO CURRENT FAULTS OR DEGRADE MESSAGES ARE DISPLAYED

**RETURN TO SERVICE**

02 SEP 1998
ASSOCIATED FAULT INDICATION(S):
MGTFII, CJCFII

DESCRIPTION:
A FADEC DEGRADE - TGT LIM LOSS (TGT LIMITER LOSS) MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

POSSIBLE CAUSES:
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:
PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION

IS FADEC MAINT ADVISORY DISPLAYED?

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

IS CONNECTOR TIGHT?


TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

AFTER DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

IS FADEC MAINT ADVISORY DISPLAYED?

01 SEP 1998
56. **FADEC DEGRADE - TGT (OR MGT) LIM LOSS MESSAGE (MFD) INCORRECTLY "ON"**

**VERIFICATION PROCEDURE:**
- Power up aircraft and control system (similar to TM 55-1520-248-23, task 9-3-10)
- Place throttle twist grip in ground idle position
- Verify FADEC DEGRADE - TGT LIM LOSS NOT displayed on MFD FADEC monitor page and FADEC MAINT not displayed on MFD initial page 1
- Using maintenance terminal verify no current faults
- To create an MGT-related fault, disconnect engine electrical harness lugs from MGT thermocouple harness terminal block and lift off to prevent grounding or contact with each other
- Verify FADEC DEGRADE - TGT LIM LOSS is now displayed on MFD FADEC monitor page and FADEC MAINT displayed on MFD initial page 1
- Reconnect engine accessory harness lugs to MGT harness terminal block and cycle ECU power off and on (breaker 10810) to clear fault
- Verify FADEC DEGRADE - TGT LIM LOSS and FADEC MAINT messages no longer displayed

**A**
Depending upon findings:
- Replace (or repair) the aircraft wiring harness connected to the ECU, the discrete indicators keyboard unit (3431A3), and the left MCPU (3431A1) similar to TM 55-1520-248-23, appendix K, section IV
- Or
- Replace the ECU (per the aircraft MM and MM TM1-2840-263-23, section 73-25-01, para. 4.A through 4.C)

**B**
Troubleshoot the aircraft wiring harness, the discrete indicators keyboard unit (3431A3), or the left MCPU (similar to TM 55-1520-248-23, appendix K, section IV)

**C**
Perform any other required running checks or maintenance checks, flights normally associated with the repairs or parts changes accomplished

Return to service

01 SEP 1999
ASSOCIATED FAULT INDICATION(S):
MGTFL, CJCFI

DESCRIPTION:
A FADEC DEGRADE - TGT LIM LOSS (TGT LIMITER LOSS) MESSAGE IS NOT DISPLAYED ON MFD. FADEC MONITOR PAGE WHEN AN ASSOCIATED FAULT IS ACTIVE.

POSSIBLE CAUSES:
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCU.
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED.
- ECU FAILURE.

PROCEED AS FOLLOWS TO RESOLVE:
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION.
- CHECK WHETHER FADEC MAINT ADVISORY IS DISPLAYED ON MFD.
- USING MAINTENANCE TERMINAL, CHECK CURRENT AND LAST ENGINE RUN FAULTS DISPLAYS.

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11).

BEFORE DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOoseness AS POSSIBLE CAUSE OF FAULT.

B (PG 2)

ARE PINS OR SOCKETS BENT, RECESSION OR MISSING?

- DISCONNECT CONNECTOR 1A6P2 AT ECU.
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED).
- CONNECT A JUMPER FROM SOCKET 14 TO GROUND AT ECU GROUNDING STRAP.
- CHECK MFD FOR FADEC MAINT ADVISORY.

IS CONNECTOR TIGHT?

- TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE.

C (PG 2)

IS FADEC MAINT ADVISORY DISPLAYED?


A (PG 2)

02 SEP 1998
57. FADEC DEGRADE - TGT (OR MGT) LIM LOSS
MESSAGE (MFD) INCORRECTLY "OFF"

A

WAS IT
DISPLAYED INITIALLY,
BEFORE DISCON-
NECTING

Yes →

TROUBLESHOOT THE
AIRCRAFT WIRING
HARNESS, THE DISCRETE
INDICATORS KEYBOARD
UNIT (3431A3), OR THE
LEFT MCPU (SIMILAR TO
TM 55-1520-248-23,
APPENDIX K, SECTION IV)

No →

REPLACE THE ECU PER
THE AIRCRAFT MM AND
TM1-2840-263-23, SECTION
73-25-01, PARA. 4.A
THROUGH 4.C

B

DEPENDING UPON FINDINGS:
REPLACE (OR REPAIR) THE
AIRCRAFT WIRING HARNESS
CONNECTED TO THE ECU, THE
DISCRETE INDICATORS
KEYBOARD UNIT (3431A3), AND
THE LEFT MCPU (3431A1)
SIMILAR TO TM 55-1520-248-23,
APPENDIX K, SECTION IV
- OR -
REPLACE THE ECU (PER THE
AIRCRAFT MM AND MM TM1-
2840-263-23, SECTION 73-25-01,
PARA. 4.A THROUGH 4.C)

C

• RECONNECT ALL
CONNECTORS
• POWER UP AIRCRAFT
AND CONTROL SYSTEM
(SIMILAR TO TM 55-1520-
248-23, TASK 9-3-10)
• CONNECT MAINTENANCE
TERMINAL AND SET UP TO
VIEW CURRENT AND LAST
ENGINE RUN FAULTS
• PERFORM MAINTENANCE
TASKS AND VERIFICATION
PROCEDURES
ASSOCIATED WITH THE
INDICATED FAULT CODES

VERIFICATION PROCEDURE:
• POWER UP AIRCRAFT AND
CONTROL SYSTEM (SIMILAR
TO TM 55-1520-248-23, TASK 9-
3-10)
• PLACE THROTTLE TWIST
GRIP IN GROUND IDLE
POSITION
• VERIFY FADEC DEGRADE-
TGT LIM LOSS NOT DISPLAYED
ON MFD FADEC MONITOR
PAGE AND FADEC MAINT
NOT DISPLAYED ON MFD INITIAL
PAGE
• USING MAINTENANCE
TERMINAL VERIFY NO
CURRENT FAULTS
• TO CREATE AN MGT-
RELATED FAULT, DISCONNECT
ENGINE ELECTRICAL HARNESS
LUGS FROM MGT
THERMOCOUPLE HARNESS
TERMINAL BLOCK AND LIFT
OFF TO PREVENT GROUNDING
OR CONTACT WITH EACH
OTHER
• VERIFY FADEC DEGRADE-
TGT LIM LOSS IS NOW
DISPLAYED ON MFD FADEC
MONITOR PAGE AND FADEC
MAINT DISPLAYED ON MFD
INITIAL PAGE
• RECONNECT ENGINE
ACCESSORY HARNESS LUGS
to MGT HARNESS TERMINAL
BLOCK AND CYCLE ECU
POWER OFF AND ON
(BREAKER 1C815) TO CLEAR
FAULT
• VERIFY FADEC DEGRADE-
TGT LIM LOSS AND FADEC
MAINT MESSAGES NO
LONGER DISPLAYED AND NO
CURRENT FAULTS ACTIVE

PERFORM ANY OTHER
REQUIRED RUNNING
CHECKS OR
MAINTENANCE CHECK
FLIGHTS NORMALLY
ASSOCIATED WITH
THE REPAIRS OR
PARTS CHANGES
ACCOMPLISHED

RETURN TO SERVICE

02 SEP 1998
Appendix D

Standard Generalized Markup Language (SGML) Tagging

- Sample SGML Tagged Data File
- Software Considerations for System Implementation
Appendix D
Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

<procinfo><task id="J-7000--3000028970" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 1"
type="N" itemid="15-SEP-98" version="J-VERSION--3000026679" status="ver"
valtype="d" servicedes="A"><text id="J-7000--3000028971" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 1">
GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 1</text></task>
<step id="J-7200--6000004725" name="***300**R6 GROUND IDLE SPEED TOO HIGH:X072001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT--6000003811">Inspect HMU control rigging IAW TMI-2840-263-23, 73-21-01, Para I.D. and adjust as required IAW (similar to) TM 55-1540-248-23, Task 4-6-1.</text></step>
<dialog id="J-7000--3000029047" itemid="15-SEP-98" agent="human">
<prompt id="J-7000--3000029051"><text itemid="14-SEP-98" ref="J-TEXT--6000004091">Was re-rigging necessary?</text></prompt></dialog></step>
<choice id="J-7000--3000029056">
<link id="J-7000--3000029057" linkends="None">Continue</link></choice>
<step id="J-7200--6000004727" name="***300**R6 GROUND IDLE SPEED TOO HIGH:X072001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT--6000003907">Perform a start to Ground Idle twist grip position and determine if Ng is within required speed band.</text></step>
<dialog id="J-7000--3000029063" itemid="15-SEP-98" agent="human">
<prompt id="J-7000--3000029067"><text itemid="14-SEP-98" ref="J-TEXT--6000003832">Is Ground Idle Ng OK?</text></prompt></dialog></step>
<choice id="J-7000--3000029070">
<link id="J-7000--3000029071" linkends="None">Continue</link></choice>
<step id="J-7200--6000004729" name="***300**R6 GROUND IDLE SPEED TOO HIGH:X072001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT--600000606">Return to service</text></step></task></procinfo>
Appendix D
Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

<doctypetype="PROCINFO PUBLIC" "//Grumman//DTD procinfo//EN"/>

<procinfo>
task="J-7000---3000028972" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 2" type="N" itemid="15-SEP-98" version="J-VERSION---3000026679" status="ver"
valtype="a" services="A" text="J-7000---3000028973" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 2">GND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 2</text>

<step id="J-7200---6000004730" name="*300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0" itemid="14-SEP-98" ref="J-TEXT---6000004029">Select Real Time Analog Data display page on Maintenance Terminal.</text>
</step>

<step id="J-7200---6000004731" name="*300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0" itemid="14-SEP-98" ref="J-TEXT---6000003908">Perform a start to Ground Idle twist grip position.</text>
</step>

<step id="J-7200---6000004732" name="*300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0" itemid="14-SEP-98" ref="J-TEXT---6000003928">Read and compare Ng indication from cockpit speed indicator and from Maintenance Terminal.</text>
</step>

<dialog id="J-7000---3000029425" itemid="15-SEP-98" agent="human">
<menu id="J-7000---3000029426" promptid="J-7000---3000029427">
<itemid="14-SEP-98" ref="J-TEXT---6000003750">Does cockpit Ng agree with Maintenance Terminal?</itemid="14-SEP-98" ref="J-TEXT---6000003908">Perform a start to Ground Idle twist grip position.</text>
</step>

<choice id="J-7000---3000029429">
<link id="J-7000---3000029432" linkends="J-7000---3000028974">Task</link>
</choice>
</dialog>

<step id="J-7200---6000004734" name="*300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0" itemid="14-SEP-98" ref="J-TEXT---6000000599">Replace or repair Multiparameter Display Ng channel IAW (Similar to TM 55-1520-248-23, Tasks 8-1-5, 8-1-6, 8-1-7, and 8-1-8).</text>
</step>

<step id="J-7200---6000004735" name="*300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0" itemid="14-SEP-98" ref="J-TEXT---6000003928">Perform a start to Ground Idle twist grip position and verify that Ng is within required speed band.</text>
</step>

<step id="J-7200---6000004736" name="*300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0" itemid="14-SEP-98" ref="J-TEXT---6000000606">Return to service.</text>
</step>
</task></procinfo>
Appendix D
Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

<DOCTYPE PROCINFO PUBLIC "//Grumman/DTD procinfo//EN" (</ArborText, Inc., 1988-1993, v.4001-->
>
<procinfo><task id="J-7000---3000028974" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 3" type="N" itemid="15-SEP-98" version="J-VERSION---3000026679" status="ver" valtype="a" servicedes="A"><text id="J-7000---3000028975" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 3">GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 3</text>
</task><step id="J-7200---6000004737" name="**300**R6 GROUND IDLE SPEED TOO HIGH
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT---6000003953">Remove and replace ECU IAW (similar to) TM 55-1520-248-23, Tasks 9-7-2* and 9-7-3.</text></step>
</step><step id="J-7200---6000004738" name="**300**R6 GROUND IDLE SPEED TOO HIGH
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT---6000003954">Perform a start and determine whether Ng is within required speed band</text></step>
</step><dialog id="J-7000---3000029456" itemid="15-SEP-98" agent="human">
<menu id="J-7000---3000029457" prompt id="J-7000---3000029458" text itemid="14-SEP-98" ref="J-TEXT---6000003832">Is Ground Idle Ng OK?</text></dialog><dialog id="J-7000---3000029462">
<link id="J-7000---3000029465" linkends="J-7000---3000027300" Task</link><text itemid="26-AUG-98" ref="J-TEXT---3000026520">Yes</text></dialog><dialog id="J-7000---3000029475" linkends="None">Continue</dialog></dialog><dialog id="J-7000---3000029476" linkends="None"></dialog><text itemid="26-AUG-98" ref="J-TEXT---3000026521">No</text></dialog></choice></dialog>
</step><step id="J-7200---6000004740" name="**300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT---600000495">Remove and replace HMU IAW TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.</text></step>
</step><step id="J-7200---6000004741" name="**300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT---6000003906">Perform a start and verify that Ng is within required speed band</text></step>
</step><step id="J-7200---6000004742" name="**300**R6 GROUND IDLE SPEED TOO HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT---600000606">Return to service</text></step></step></task></procinfo>

<DOCTYPE PROCINFO PUBLIC "//Grumman/DTD procinfo//EN" (</ArborText, Inc., 1988-1993, v.4001-->
>
<procinfo><task id="J-7000---3000028945" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW START" type="N" itemid="15-SEP-98" version="J-VERSION---3000026679" status="ver" valtype="a" servicedes="A"></task><link id="J-7000---3000031876" linkends="T703">Partinfo
Appendix D

Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

GROUND IDLE SPEED TOO HIGH OR TOO LOW START

**HIGH:**X00720001_HGOMAR6

**HIGH:**X00720001_HGOMAR6

If the throttle lever angle on the HMU is between 12 and 40 degrees, Ng must be 64% + TBD%. If not within this speed band, maintenance action is required.

Likely causes of improper Ng at Ground Idle are:

- Cockpit Ng instrumentation error
- HMU
- ECU

If an out-of-limits Ground Idle Ng condition is encountered, connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear.

Continue

Yes

No

Perform a start to Ground Idle twist grip position and determine if Ng is within required speed band.

Is Ground Idle Ng OK?

None
Appendix D

Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

<link id="J-7000---3000029036" linkends="None">Continue</link><text itemid="26-AUG-98" ref="J-TEXT---3000026520">Yes</text></choice>
<link id="J-7000---3000029038" linkends="None">Task</link><text itemid="26-AUG-98" ref="J-TEXT---3000026521">No</text></choice></menu></dialog></step>
<step id="J-7200---6000004724" name="***300**R6 GROUND IDLE SPEED TOO HIGH:007200001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver esttime"="0.0">Return to service</step></procinfo>
Software Overview

- JSTARS is an Air Force Acquisition Program for the next generation AWACS.
- Uses Commercial Off The Shelf (COTS) software in conjunction with Northrop Grumman as a piece of an overall maintenance information system.
- Developed by Northrop Grumman as a piece of an overall maintenance information platform.
- JSTARS Integrated Maintenance Information System (JIMIS) authoring software.

- Oracle database
- Adept Publishing (SGML tagging)
- Intercap MetaLink for graphics
T703-C3OR3 Troubleshooting Data SGML Development

- **SGML Data Types**
  - The JIMIS IETM authoring and presentation software contains many different types of data for use in aircraft maintenance. In addition to the types listed below JIMIS includes parts information, graphics, reference material, tools, support equipment and more. Due to the scope of this project only the following have been used:
    - **Tasks**
    - Contains all the other data types
    - **Steps**
    - Contain text and dialogs (graphics if used)
    - **Text**
    - Authored once used many times (cuts down size of database)
    - **Dialogs**
    - Present choices which will determine what will be seen next, are made up of the following data types:
      - **Menu** - Presents viewer with a question or selection
      - **Prompt** - Question or selection criteria
      - **Choice** - Displays possible answer or choice
      - **Links** - Three types Task, Dialog, Continue. Task provides avenue to next path, Dialog if additional questions are required, Continue if additional steps are required in current troubleshooting path.
Task Construction

Task - STARTER WILL NOT MOTOR ENGINE

Step - ID# 300001000
Text - ID# 300001001
Check electrical connections on starter

Dialog - ID# 300001002
Menu - ID# 300001003
Prompt - ID # 300001004
Text - ID # 300001005
Are connections secure?
Choice - ID # 300001006
Link - ID # 300001007
Text - ID # 300001008
Yes
Choice - ID # 300001009
Link - ID # 300001010
Text - ID # 3000010011
No
T703 -C30R3 Troubleshooting Data SGML Development

- Task Development
  - Source data in the form Visio troubleshooting charts.
  - Copied text from charts into Excel, exported into a database then ran through a filter.
  - Filter creates pseudo tasks (assigns step and text tags with ID numbers). Filter creates one pseudo task for each troubleshooting chart.
  - Used pseudo task to build tasks (multiple tasks created to facilitate multiple troubleshooting paths).
  - Created dialog and linking information (links used to join dialogs and tasks together).
  - Created information in authoring in order to allow display in presentation (FOSI).
  - Performed Quality Check to insure tasks matched each path of the troubleshooting charts.
T703 -C30R3 Troubleshooting Data SGML Development

- **DTD:** (Document Type Definition) A DTD is the formal definition of the elements, structures, and rules for marking up a given type of SGML document. You can store a DTD at the beginning of the document or externally in a separate file.

- **FOSI:** (Formatting Output Specification Instance) A FOSI is used for formatting SGML documents for printing and other outputs. It is a separate file that contains formatting information for each element in a document.
Appendix E

Test Equipment Required to Perform Troubleshooting/Diagnostic Tasks
SPECIAL TEST EQUIPMENT REQUIRED TO PERFORM MAINTENANCE TASKS

1. **Thermocouple Simulator/Calibrator**, such as OMEGA Model CL-300-1000C-K or equivalent, for measured gas temperature.

2. **Pressure Transducer and Readout**, 0 - 150 psig, for main oil pressure and torque sensor pressure (accuracy ± 1.0% of full scale).

3. **FADEC Maintenance Terminal** -- a laptop PC with specialized software, that communicates with the FADEC through the aircraft mounted FADEC test port. This could be the same PC used by the mechanic to maintain the engine.

4. **Electrical Connectors**, with stub wires attached to all active pins or sockets, to mate to the following engine and aircraft connectors (ref. Rolls-Royce Allison Electrical Installation Connection Diagram), for use in performing electrical continuity and resistance checks of electrical and electronic components: 1A6P1, 1A6P2, 1A8J1, 1A9J1, 1J12, 1MT10P1, 1P2, 1P3, 1P10, 4A2J1, J4, J7, J10, J11, AND P6.

5. **Frequency Generator**, to simulate signals from Ng and Np speed pick-ups. Requirements: *frequency* 2 Khz to 20 Khz, *input impedance* 100W to 150W.

6. **Volt-Ohm Meter**, for use in performing electrical continuity and resistance checks of electrical and electronic components, particularly as related to the FADEC. Requirements: *voltage* - accuracy of ± 0.1% of full scale on 200 volt range; *resistance* - accuracy of ± 0.05% of full scale on 200 ohm range, ± 0.5% all other ranges, able to measure 50 milliohms within ± 5 milliohms using a 4-wire configuration, must not supply more than 5 milliamperes when measuring potentiometer resistances as excess current may cause damage.

These items of equipment could be configured as individual modules or integrated into a single unit.
## Applicability to Fault Correction Procedures

### T703-AD-700 ENGINE

<table>
<thead>
<tr>
<th>FAULT ITEM NO.*</th>
<th>TEST EQUIPMENT ITEM NO.*</th>
<th>FAULT ITEM NO.*</th>
<th>TEST EQUIPMENT ITEM NO.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-5</td>
<td>1</td>
<td>ST-2</td>
<td>3</td>
</tr>
<tr>
<td>ST-6</td>
<td>1</td>
<td>ST-3</td>
<td>3</td>
</tr>
<tr>
<td>RG-4</td>
<td>5</td>
<td>ST-4</td>
<td>3</td>
</tr>
<tr>
<td>RG-5</td>
<td>5</td>
<td>ST-5</td>
<td>3</td>
</tr>
<tr>
<td>RG-6</td>
<td>5</td>
<td>ST-6</td>
<td>3</td>
</tr>
<tr>
<td>RGF-5</td>
<td>5</td>
<td>ST-7</td>
<td>3</td>
</tr>
<tr>
<td>RGF-12</td>
<td>2</td>
<td>ST-8</td>
<td>3</td>
</tr>
<tr>
<td>RGF-13</td>
<td>2</td>
<td>ST-9 1, 3, 6</td>
<td>R-24 3</td>
</tr>
<tr>
<td>RGF-14</td>
<td>2</td>
<td>ST-10</td>
<td>2</td>
</tr>
<tr>
<td>RGF-15</td>
<td>2</td>
<td>R-1</td>
<td>6</td>
</tr>
<tr>
<td>RGF-16</td>
<td>2</td>
<td>R-2</td>
<td>3</td>
</tr>
<tr>
<td>RF-1</td>
<td>1, 2, 5</td>
<td>R-4</td>
<td>3</td>
</tr>
<tr>
<td>RF-3</td>
<td>1</td>
<td>R-6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-9</td>
<td>3</td>
</tr>
</tbody>
</table>

### 250-C30R/3 BASIC ENGINE

<table>
<thead>
<tr>
<th>FAULT ITEM NO.*</th>
<th>TEST EQUIPMENT ITEM NO.*</th>
<th>FAULT ITEM NO.*</th>
<th>TEST EQUIPMENT ITEM NO.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3, 4, 6</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3, 4, 6</td>
<td>31</td>
<td>3, 4, 6</td>
</tr>
<tr>
<td>3</td>
<td>3, 4, 6</td>
<td>32</td>
<td>3, 4, 6</td>
</tr>
<tr>
<td>4</td>
<td>3, 4, 6</td>
<td>33</td>
<td>3, 4, 6</td>
</tr>
<tr>
<td>5</td>
<td>3, 4, 6</td>
<td>34</td>
<td>3, 4, 6</td>
</tr>
<tr>
<td>6</td>
<td>3, 4, 6</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>3, 4, 6</td>
<td>36</td>
<td>3, 4, 6</td>
</tr>
<tr>
<td>8</td>
<td>3, 4, 6</td>
<td>37</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>3, 4, 6</td>
<td>38</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>3, 4, 6</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>3, 4, 6</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>3, 4, 6</td>
<td>41</td>
<td>3, 5</td>
</tr>
<tr>
<td>13</td>
<td>3, 4, 6</td>
<td>42</td>
<td>3, 4</td>
</tr>
<tr>
<td>14</td>
<td>3, 4, 6</td>
<td>43</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>44</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>3</td>
<td>45</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>3, 4, 6</td>
<td>46</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>3, 4, 6</td>
<td>47</td>
<td>3, 4, 6</td>
</tr>
<tr>
<td>19</td>
<td>3, 4, 6</td>
<td>48</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>3, 4</td>
<td>49</td>
<td>3</td>
</tr>
<tr>
<td>21</td>
<td>3, 4, 6</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>22</td>
<td>3</td>
<td>51</td>
<td>3</td>
</tr>
<tr>
<td>23</td>
<td>3, 4, 6</td>
<td>52</td>
<td>3</td>
</tr>
<tr>
<td>24</td>
<td>3</td>
<td>53</td>
<td>3</td>
</tr>
<tr>
<td>25</td>
<td>3</td>
<td>54</td>
<td>3</td>
</tr>
<tr>
<td>26</td>
<td>3, 4, 6</td>
<td>55</td>
<td>3, 4</td>
</tr>
<tr>
<td>27</td>
<td>3</td>
<td>56</td>
<td>3</td>
</tr>
<tr>
<td>28</td>
<td>3</td>
<td>57</td>
<td>3, 4</td>
</tr>
<tr>
<td>29</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 250-C30R/3 FADEC

**FAULT ITEM NO.* REFERS TO MAINTENANCE FAULTS LISTED IN TABLES I, II, AND III

**TEST EQUIPMENT ITEM NO. REFERS TO ABOVE LIST OF SPECIAL TEST EQUIPMENT**

EDR 18982