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Gravity Probe B Relativity Mission

# BURN-IN PROCEDURE FOR THE GYROSCOPE SUSPENSION SYSTEM (GSS) AFT SUSPENSION UNIT (ASU) SUBSYSTEM

## GP-B Procedure
## P0705 Rev –

DUT PN: 26226-101 REV _____ SN: _____
Date Performed:_____

| | |
|---|---|
| Prepared by: Scott Smader | Date |
| Approved by: William Bencze<br>Payload Electronics Manager. | Date |
| Approved by: Dorrene Ross<br>GP-B Quality Assurance | Date |
| Approved by:<br>GP-B System Engineering | Date |

| | | | |
|---|---|---|---|
| Total power-on time for this procedure (hrs): | | Record P-number and section of master test procedure, if applicable: | Called by:<br><br>Date: |

**Table of Contents:**



## 1.0 Revision History

| Rev Level | Comments/notes | Date | Revised By |
|---|---|---|---|
| - | First release of this test procedure | 1-May-2001 | S Smader |

## 2.0 Scope:

This procedure details the operations required to perform a box-level burn-in test on a GSS aft unit, PN 26226-101

## 3.0 Formal Requirements Verification

This procedure verifies by test and/or inspection the following GSS box-level requirements:

| Item | Spec Paragraph PLSE 13-1 Rev A | Requirement Title | Verified via test item in this procedure: |
|---|---|---|---|
| 3.1. | 3.2.3 | Communications Interfaces | 16.0 |
| 3.2. | 3.2.4 | Software command interfaces | 16.0 |
| 3.3. | 3.2.5 | HLD interfaces | 0 |
| 3.4. | 3.2.8.1 | SRE Interfaces | 16.0 |
| 3.5. | 3.2.8.2 | Operation during clock switching | 16.0 |
| 3.6. | 3.2.8.4.1 | Recovery from missed timing pulses | 16.0 |
| 3.7. | 3.2.8.4.2 | Recovery from extra timing pulses | 16.0 |
| 3.8. | | Burn-in | |

## 4.0 Reference Documents

| | | |
|---|---|---|
| 4.1. | PLSE 13-1 Rev A | GSS Specification |
| 4.2. | P0663 | GSS Gold System Hardware and Software Configuration Standard |
| 4.3. | P0772 | Aft Full Functional Software Test Procedure using GSS test environment. |
| 4.4. | P0758 | GSS GSE Electrical Test Procedure |
| 4.5. | 26224 | Assembly Drawing for the Aft Computer Unit (ACU) |
| 4.6. | 26226 | Assembly Drawing for the Aft Suspension Unit (ASU) |
| 4.7. | MIL-STD-1686 | Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment |
| 4.8. | P0670 | GSS Test Software Users Guide |

## 5.0 Test Facilities

5.1. Primary facility: HEPL Room 127, Stanford University

5.2. Alternate facility (specify):_____

## 6.0 QA Provisions:

6.1. This procedure shall be conducted on a formal basis to its latest approved and released version. The QA Program Engineer (D. Ross) and the Government representative (E. Ingraham) shall be notified 24 hours prior to he start of this procedure. QA may monitor the execution of all or part of this procedure should they elect to do so.

Date/time:_____ Date/time:_____

GP-B QA (D. Ross) Government Rep. (E. Ingraham)

6.2. Upon completion of this procedure, the GSS manager and the GP-B QA manager shall certify her/his concurrence that the procedure was performed and accomplished in accordance with the prescribed instructions by signing and dating his approval at the end of this procedure.

## 7.0 Test Personnel

This test procedure is to be conducted only by the following personnel, or others designated by the GSS RE at the time of test (redline names in below as required)

7.1. William Bencze

7.2. Ron Zilm

7.3. Scott Smader

7.4. Lo Van Ho

7.5. Joseph Kilner

## 8.0 General Instructions

8.1. Redlines can be initiated by the test personnel listed in Section 7.0 and must be approved by QA.

8.2. Test operators shall read this procedure in its entirety and resolve any apparent ambiguities prior to beginning this test.

8.3. Any nonconformance or test anomaly should be reported by a Discrepancy Report. Refer to the Quality Plan, P0108, for guidance. Do not alter or break test configuration if a test failure occurs; notify quality assurance.

8.4. Only the following persons have the authority to exit/terminate this test or perform a retest: test operators listed in Section 7.0 and GP-B QA.

8.5. In this document, “Perform Flight S/W system test commands:” means to prepare the test system software as described in P0670 Board-Level Test Software Operational Procedure, and then issue the listed commands according to the procedure described in P0670.

## 9.0 Hardware Safety and Data Recording Requirements

9.1. Electrostatic Discharge (ESD) Protection:

9.1.1. This assembly is ESD sensitive; special care shall be exercised per the "Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment", MIL-STD-1686.

9.2. Connectors/Cables:

9.2.1. Ensure that power is removed from cable assemblies before connecting or disconnecting cable connectors.

9.2.2. Connector savers are to be used on all flight connector interfaces unless otherwise specified.

9.2.3. All mates and de-mates to flight connector interfaces (not to connector saver interfaces) shall be recorded in the **Connector Mate/Demate Log** for this assembly

9.2.4. Connectors shall be examined before attempting to mate them. Remove any foreign particles. Look for any damaged pins or sockets. Do not force the coupling action if excessive resistance is encountered. Ensure that key-ways are aligned when mating connectors.

9.3. Application of Power:

9.3.1. Power on and off times shall be recorded in the **Power Log** for this assembly.

## 10.0 External Test Equipment

The following support hardware will be used and the applicable information for the instruments shall be recorded below. Hand-written additions to this list may be made in the space provided.

| Item | Equipment Description | Qty | Make | PN | SN | Cal Due |
|---|---|---|---|---|---|---|
| 1. | GSS Spacecraft emulator | 1 | SU | NA | 01 | |
| 2. | GSS FSU gold system | 1 | SU | NA | 01 | |
| 3. | FSU Power supply, triple output | 1 | HP/Agilent | | | |
| 4. | FSU Power supply, 50 V | 1 | HP/Agilent | | | |
| 5. | Multimeter | 1 | Fluke | | | |
| 6. | Oscilloscope + probes | 1 | Tek | TDS460A | | |
| 7. | 2-stub 1553 coupler | 2 | MilesTek | 90-50202 | | NA |
| 8. | FSU PC630 power cable | 1 | SU | NA | 01 | NA |
| 9. | GSS testset workstation | 1 | SU | NA | NA | NA |
| 10. | GSE power cable | 1 | LMCO | 8A02084GSE-101 | NA | NA |
| 11. | GSE timing cable | 1 | LMCO | 8A02085GSE-101 | NA | NA |
| 12. | GSE GFAB A cable | 1 | LMCO | 8A01473-101 | NA | NA |
| 13. | GSE GFAB B cable | 1 | LMCO | 8A01474-101 | NA | NA |
| 14. | GSE 1553 cable | 2 | LMCO | 8A00673GSE-501 | NA | NA |
| 15. | 1553 terminator | 4 | MilesTek | 10-06403-025 | NA | NA |
| 16. | 1553 patch cable | 2 | Trompeter | CA-2014-120 | NA | NA |
| 17. | APU J21 breakout box | 1 | SU | NA | 01 | NA |
| 18. | DB15 breakout box | 1 | SU | NA | 01 | NA |
| 19. | | | | | | |
| 20. | | | | | | |
| 21. | | | | | | |
| 22. | | | | | | |
| 23. | | | | | | |

**End of Section**

## 11.0 Software Environment

*This test shall be run using the GSS developed test environment, known collectively as "PitView".*

11.1. An as-run copy of a subordinate procedure shall be completed and attached to this document each time the test is run.

11.2. Fill in the version of software used in this test.

| Name and Description | Version Number / Date, Time & Size |
|---|---|
| SUN Solaris Operating System* | |
| GSS System software (GSW) | |
| gssloader - The shell script to load GSS software into SRAM memory on gss flight processor via 1553 bus. Runs on SUN Solaris OS | |
| gss1553ramload - The executable that loads the GSS software into SRAM memory on gss flight processor via 1553 bus. This executable is launched by the gssloader shell script and receives its setup values via rtloader_setup data file. | |
| rtloader_setup - Is a data file containing necessary setup information to configure gss1553ramload. | |
| ShmServer - Shared Memory Telemetry Server | |
| cmdClient - Command Client | |
| pitView4 – PitView window interface | |
| pitView3.pV3 - PitView database file | |
| startall - C shell script | |
| shmsmon – shared memory script | |
| 772.r6s – script file for this test | |

Notes:

* These items are provided by LMMS/Stanford System Administrator and are kept current in the red software revision logs that travel with the G.S.S. test sets.

Version numbers for all GSS products will be provided by the test director to fill in the blanks, along with the products on a storage medium (CD or floppy or tape).

**End of Section**

## 12.0 Equipment Pretest Requirements:

12.1. The GSS Gold System items with which this subsystem is to be tested must have passed the P0663 – Gold System Certification Procedure prior to the start of this test. Record the Gold System serial number and date of its certification, below

| | | |
|---|---|---|
| GSS Gold System | SN: | |
| | Date of Certification | |
| | Configuration (circle one) | Full Partial |

| | P/F | Notes: |
|---|---|---|
| 12.2. Verify P0758 has been run on the Spacecraft Emulator GSE within the past 60 days or since the rack has been moved to the current test location. | | Date:<br>Revision: |

## 13.0 Device Under Test (DUT):

Record the serial number of the Device Undergoing Test, or DUT.

| | | |
|---|---|---|
| 26226-101 GSS Aft Suspension Unit (ASU) | SN: | |

| | | |
|---|---|---|
| Test Operator: | Name: | |

| | | |
|---|---|---|
| Start of test: | Date:<br>Time: | |

## 14.0 Pre-Burn-In HLD Tests

*Verifies operation of the HLD (high level discrete) functions*

| | | P/F | Notes |
|---|---|---|---|
| 14.1. | Turn off power to Aft unit via the *GSE Test* panel. | | |
| 14.2. | Set bus voltage to ASU to **28.0 V** as indicated on the *GSE Test* window. | | |
| 14.3. | Connect FSU power breakout box to APU J21 | | |
| 14.4. | Verify voltage levels on breakout box for the following configuration of FSU power and HLD signals:<br>**Leave Aft power OFF during this test.** | | |

| **Inputs** | | | | | **Outputs on APU J21 (pins)** | | | | | | | | **P/F** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FSU Pri | FSU Sec | Heater | HLD A | HLD B | 2 | 12 | 11 | 5 | 3 | A1 | A2 | 6 | |
| off | off | off | off | off | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ON | off | off | off | off | +7.2 ± 0.5 | +16.2 ± 0.5 | -16.2 ± 0.5 | +60.5 ± 1.0 | -60.5 ± 1.0 | x | x | x | |
| off | ON | off | off | off | | | | | | x | x | x | |
| ON | ON | off | off | off | | | | | | x | x | x | |
| ON | ON | off | off | ON | x | x | x | x | x | +870 ± 30 | -870 ± 30 | x | |
| ON | ON | off | ON | off | | | | | | +870 ± 30 | -870 ± 30 | x | |
| ON | ON | off | ON | ON | | | | | | +1680 ± 50 | -1680 ± 50 | x | |
| x | x | ON | x | x | x | x | x | x | x | x | x | 12 | |
| **Measured w.r.t pin (ground):** | | | | | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 13 | |

Measure high voltages A1 and A2 with HV probe; use banana jumper to connect meter to J21 pin 4 on breakout box.

"x" = Don't care.

| | | | |
|---|---|---|---|
| 14.5. | Return FSU Primary, FSU secondary, and Heater power ports to the off condition. Disconnect FSU breakout box from APU J21. | | |

End of section

## 15.0 Burn-In Test Connection

*Note:* *All handling of this DUT shall be performed using ESD control methods, as outlined in MIL-STD-1686. Unit shall be inspected at an ESD certified station. Wrist straps and/or heel grounding straps shall be used.*

**Important:** **Insure that power is removed from cable assemblies before connecting or disconnecting cable connectors.**

| | | P/F | Notes |
|---|---|---|---|
| 15.1. | If this procedure has been called by another test procedure, record the P-number and section that made the callout on the space provided on the coversheet of this document. | | |
| 15.2. | Remove DUT from storage container. Verify that all connectors appear undamaged | | |
| 15.3. | Verify that LabView is not running on the S/C emulator PC. | | |
| 15.4. | Verify that the front panel of the HP power supply indicates 0.0V output. | | |
| 15.5. | Configure the system as shown in Figures 1, 2 and 3. | | |

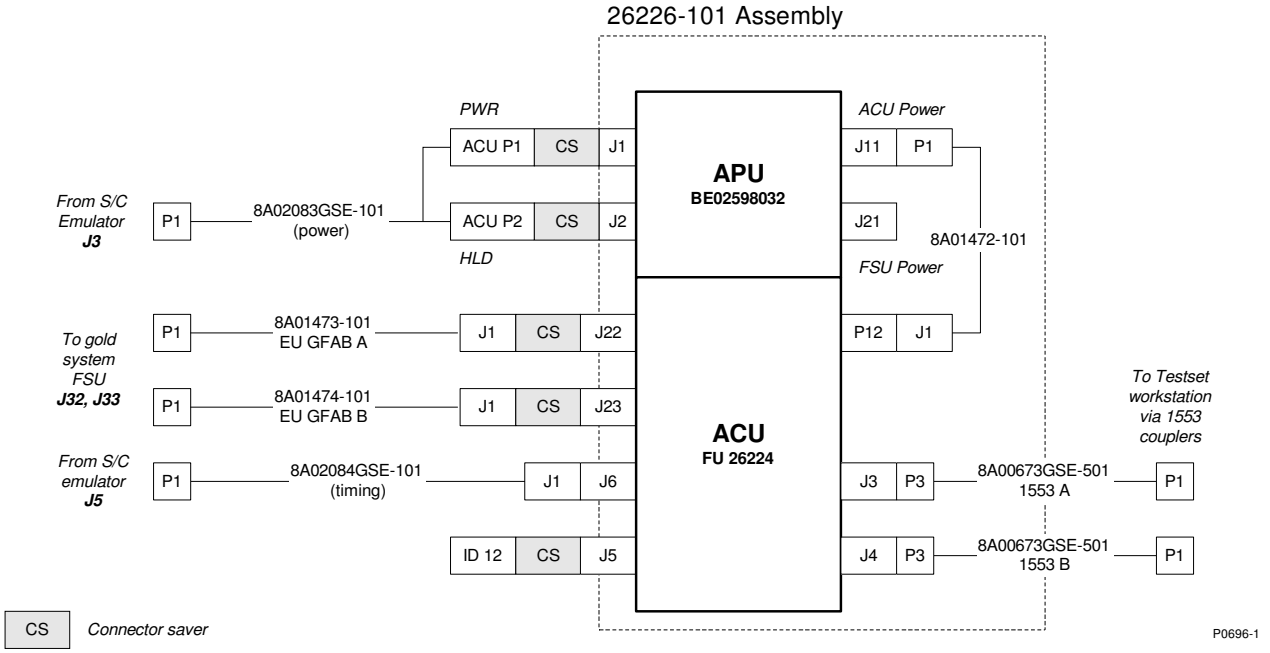


Figure 1: Connection Diagram for ASU tests

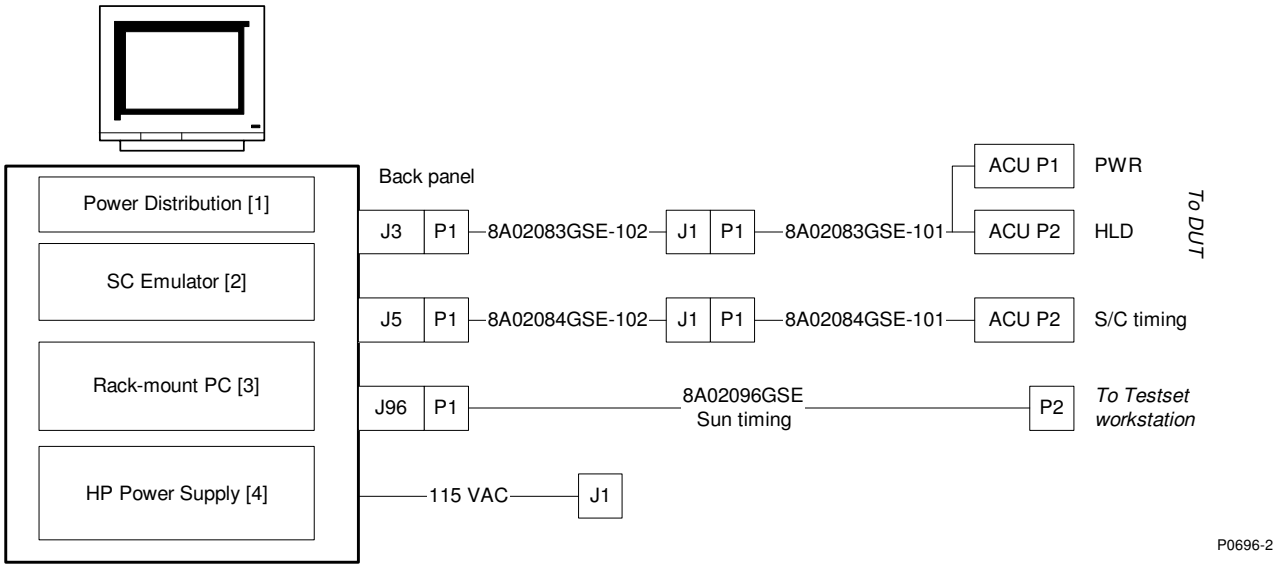


Figure 2: Spacecraft Emulator Wiring Diagram

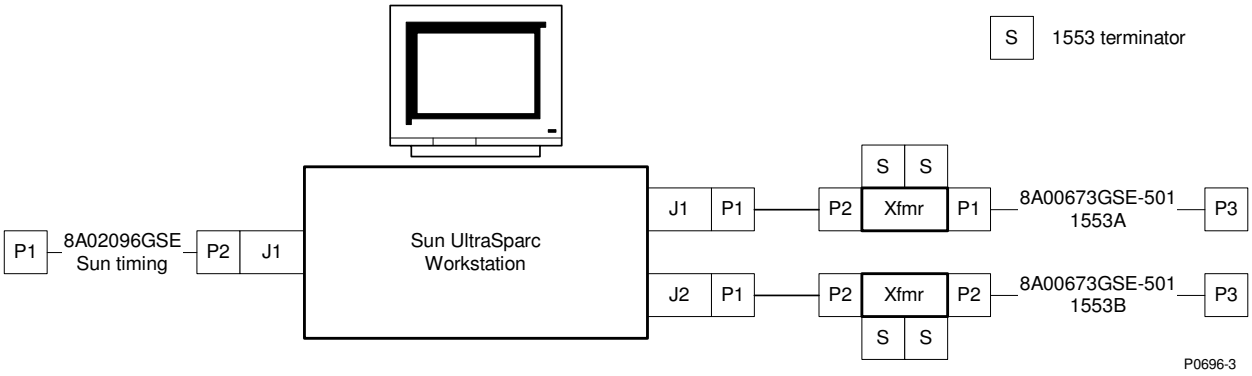


Figure 3: Testset workstation wiring diagram

**End of Section**

| | | P/F | Notes |
|---|---|---|---|
| 15.6. | Set current limit on HP power supply in S/C emulator rack to 2.0 A<br>A) Close any LabView program that may be running.<br>B) Key in the following sequence on the front panel of the HP supply:<br>"**LOCAL, Function: CURRENT, 2.0, ENTER**" | | |
| 15.7. | Restart the LabView *GSE Test* virtual instrument. | | |
| 15.8. | Set supply voltage to **28.0 V** on the *GSE test* panel. | | |
| 15.9. | Set Spacecraft clock simulator to the following:<br>**16fo: A + B**<br>**10 Hz: A + B**<br>**Sun 10 Hz: A + B** | | |
| 15.10. | Apply power via by turning on "Aft Main" on LabView control panel; record power on time in Power Log for this unit. | | |
| **15.11.** | **Verify that current is < 550 mA; if greater remove power and cancel test.** | | |
| 15.12. | Record indicated main bus current as indicated on HP power supply front panel. | | Current: |

**End of Section**

## 16.0 Pre-Burn-In Software Tests:

*Verifies operation of the software communication and command interfaces, operation of 1553 bus, A side and B side; Tests the operation over full required bus voltage range.*

**Note: Record power on and power off cycles in Power Log for this unit.**

| | | P/F | Notes |
|---|---|---|---|
| 16.1. | Confirm bus voltage to ASU is **28.0 V** as indicated on the *GSE Test* window. | | |
| 16.2. | Perform "AFT FULL" software functional test per procedure specified in Section 11.0 | | |
| 16.3. | Attach completed copy of the software test procedure. | | Log filename: |
| 16.4. | Turn off power to unit via the *GSE Test* panel. | | |
| 16.5. | Set bus voltage to ASU to **21.0 V** as indicated on the *GSE Test* panel. | | |
| 16.6. | Turn on power to unit via the *GSE Test* panel. Record current from front panel of HP power supply at right: | | Current: |
| 16.7. | Perform "AFT FULL" software functional test per procedure specified in Section 11.0 | | |
| 16.8. | Attach completed copy of the software test procedure. | | Log filename: |
| 16.9. | Turn off power to unit via the *GSE Test* panel. | | |
| 16.10. | Set bus voltage to ASU to **35.0 V** as indicated on the *GSE Test* window. | | |
| 16.11. | Turn on power to unit via the *GSE Test* panel. Record current from front panel of HP power supply at right: | | Current: |
| 16.12. | Perform "AFT FULL" software functional test per procedure specified in Section 11.0 | | |
| 16.13. | Attach completed copy of the software test procedure. | | Log filename: |
| 16.14. | Turn off power to unit via the *GSE Test* panel. | | |
| 16.15. | Set bus voltage to ASU to **28.0 V** as indicated on the *GSE Test* window. | | |
| 16.16. | Turn on power to unit via the *GSE Test* panel. Record current from front panel of HP power supply at right: | | Current: |

End of Section

## 17.0 Burn-In Software Tests:

Copy and complete the instructions in this section at least once every 32 hours until total power-on time for unit as recorded in ASU Power Log reaches or exceeds 300 hours. Attach all copies to this procedure.

Perform the following Flight S/W system test commands at least once every 32 hours:

| | |
|---|---|
| 17.1. Record Date and Time: | Date & Time: |
| 17.2. Record indicated main bus current as indicated on HP power supply front panel. | Current: |
| 17.3. Record indicated main bus voltage as indicated on HP power supply front panel. | Voltage: |
| 17.3.1. Perform Flight S/W system test commands:<br>14, 1<br>14, 29<br>14, 38<br>If all of the above tests return “Success”, circle Pass; else circle Fail. | Pass Fail |
| 17.3.2. Operator Initials: | Initials: |

End of Section

## 18.0 Post-Burn-In Software Tests:

*Verifies operation of the software communication and command interfaces, operation of 1553 bus, A side and B side; Tests the operation over full required bus voltage range.*

**Note: Record power on and power off cycles in Power Log for this unit.**

| | | P/F | Notes |
|---|---|---|---|
| 18.1. | Confirm bus voltage to ASU is **28.0 V** as indicated on the *GSE Test* window. | | |
| 18.2. | Perform "AFT FULL" software functional test per procedure specified in Section 11.0 | | |
| 18.3. | Attach completed copy of the software test procedure. | | Log filename: |
| 18.4. | Turn off power to unit via the *GSE Test* panel. | | |
| 18.5. | Set bus voltage to ASU to **21.0 V** as indicated on the *GSE Test* panel. | | |
| 18.6. | Turn on power to unit via the *GSE Test* panel. Record current from front panel of HP power supply at right: | | Current: |
| 18.7. | Perform "AFT FULL" software functional test per procedure specified in Section 11.0 | | |
| 18.8. | Attach completed copy of the software test procedure. | | Log filename: |
| 18.9. | Turn off power to unit via the *GSE Test* panel. | | |
| 18.10. | Set bus voltage to ASU to **35.0 V** as indicated on the *GSE Test* window. | | |
| 18.11. | Turn on power to unit via the *GSE Test* panel. Record current from front panel of HP power supply at right: | | Current: |
| 18.12. | Perform "AFT FULL" software functional test per procedure specified in Section 11.0 | | |
| 18.13. | Attach completed copy of the software test procedure. | | Log filename: |

**End of Section**

## 19.0 Post Burn-In HLD Tests

*Verifies operation of the HLD (high level discrete) functions*

| | | P/F | Notes |
|---|---|---|---|
| 19.1. | Turn off power to Aft unit via the *GSE Test* panel. | | |
| 19.2. | Set bus voltage to ASU to **28.0 V** as indicated on the *GSE Test* window. | | |
| 19.3. | Connect FSU power breakout box to APU J21 | | |
| 19.4. | Verify voltage levels on breakout box for the following configuration of FSU power and HLD signals:<br>**Leave Aft power OFF during this test.** | | |

| **Inputs** | | | | | **Outputs on APU J21 (pins)** | | | | | | | | **P/F** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FSU Pri | FSU Sec | Heater | HLD A | HLD B | 2 | 12 | 11 | 5 | 3 | A1 | A2 | 6 | |
| off | off | off | off | off | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ON | off | off | off | off | +7.2 ± 0.5 | +16.2 ± 0.5 | -16.2 ± 0.5 | +60.5 ± 1.0 | -60.5 ± 1.0 | x | x | x | |
| off | ON | off | off | off | | | | | | x | x | x | |
| ON | ON | off | off | off | | | | | | x | x | x | |
| ON | ON | off | off | ON | x | x | x | x | x | +870 ± 30 | -870 ± 30 | x | |
| ON | ON | off | ON | off | | | | | | +870 ± 30 | -870 ± 30 | x | |
| ON | ON | off | ON | ON | | | | | | +1680 ± 50 | -1680 ± 50 | x | |
| x | x | ON | x | x | x | x | x | x | x | x | x | 12 | |
| **Measured w.r.t pin (ground):** | | | | | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 13 | |

Measure high voltages A1 and A2 with HV probe; use banana jumper to connect meter to J21 pin 4 on breakout box.

"x" = Don't care.

| | | | |
|---|---|---|---|
| 19.5. | Return FSU Primary, FSU secondary, and Heater power ports to the off condition. Disconnect FSU breakout box from APU J21. | | |

End of section

## 20.0 Completion of Procedure:

| | | P/F | Notes |
|---|---|---|---|
| 20.1. | Turn off power via LabView *GSE Test* window; record off time in Power log. | | |
| 20.2. | Remove all external cables from ASU | | |
| 20.3. | Return DUT to storage container. | | |
| 20.4. | Attach test results from Section 16.0 | | |

**End of Section**

## 21.0 Certification:

I certify that this procedure was performed in whole and that the data recorded above is complete and accurate.

| Test Engineer | | Date | |
|---|---|---|---|

This is to certify that the information obtained under this test procedure is as represented and the documentation is completed and correct.

| GSS Representative | | Date | |
|---|---|---|---|
| Quality Assurance | | Date | |