

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Magnetic Pickups (Part of APU)

PART NO.: 5906050
5908322 (Alt)
(Part of 10201-0049)

FM CODE: A02

ITEM CODE: 20-01-22

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 4

DATE: March 31, 1997

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 1, 1995

FMEA PAGE NO.: A-66

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SHEET 1 OF 7

APPROVED: P. Kalia

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FAILURE MODE AND CAUSES: No output (magnetic pickups MPU no. 1 and MPU no. 2) for APU A or B caused by:

- o Electrical open/short circuit
- o Probe failure due to material or manufacturing defects
- o Contamination/Corrosion
- o Improper Installation

FAILURE EFFECT SUMMARY: Fire and explosion will result in loss of mission, vehicle and crew.

REDUNDANCY SCREENS AND MEASUREMENTS:

- 1) Pass - Units are subject to Sundstrand ATP TS2409 Rev. Y during turnaround and refurbishment.
- 2) Fail - Units are not checked during final countdown until APU start up, at which time the failure can occur.
- 3) Fail - Contamination.

RATIONALE FOR RETENTION:

A. DESIGN

- The Magnetic Pickups are designed and qualified in accordance with end item specification 10SPC-0050. (All Failure Causes)
- o The MPU housing provides redundant seals at the electrical connections to prevent intrusion of corrosives and contaminants. (Electrical Open/Short Circuit, Contamination/Corrosion)

- o Inspection ports are sealed with an O-ring and dynatube pressure cap. (Contamination/Corrosion)
- o Bearing spacer is demagnetized prior to assembly of the bearing assembly. (Probe Failure Due to Material or Manufacturing Defects)
- o O-ring material is ethylene propylene except innermost seal which is viton. (Contamination/Corrosion)
- o O-rings are lubricated prior to installation. (Contamination/Corrosion)
- o External surfaces are designed to be corrosion resistant to hydrazine, lube oil and salt water. (Probe Failure Due to Material or Manufacturing Defects, Contamination/Corrosion)
- o The MPU housing assembly is installed with polysulfide sealant and high strength bolts. The sealant is applied between the MPU housing and the APU housing. (Contamination/Corrosion)
- o Each speed sensor is a coil wound bobbin covered with heat shrink tubing connected to a magnet and its associated wire leads. These items are all contained in individual sensor housings. (Electrical Open/Short Circuit, Contamination/Corrosion)
- o The terminal area of each sensor is totally potted to prevent open/short circuits. (Electrical Open/Short Circuit)
- o The sensor assembly/cable interface connector back shell is fully potted. (Electrical Open/Short Circuit)
- o The aft skirt area is purged with GN2 prior to APU start up. This reduces the O2 concentration to less than four percent per OMRSD File II, Vol. 1, requirement number S00FM0.430. (All Failure Causes)
- o Qualification testing verified design requirements as reported in Sundstrand APU Qualification Test Report AER 1539-6, Rev. B. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per Sundstrand ATP TS 2409 on all new units. This includes resistance checks, a GN2 spin, hotfire acceptance test, insulation resistance test, insulation current leakage test and electrical check. (All Failure Causes)
- o APU MPU oscilloscope traces are monitored during ATP to ensure no residual magnetization is present per Sundstrand ATP TS 2409. (Probe Failure Due to Material or Manufacturing Defects)
- o Lube oil sampling for cleanliness and composition (purity and particulate count) is performed prior to loading per 10REQ-0021, para. 2.3.2.3. (Contamination/Corrosion)

- o Lube oil filter is removed and inspected after hotfiring per 10REQ-0021, para. 2.3.16.5.e.2 (Contamination/Corrosion).
- o During refurbishment and prior to reuse the APU and its components are subjected to the same ATP as new units. (All Failure Causes)
- o BITE test to verify electrical continuity of the speed sensors prior to hotfire operations is performed per 10REQ-0021, para. 2.3.4. (Electrical Open/Short Circuit)
- o TVC system functional test is performed during hotfire operations per 10REQ-0021, paras. 2.3.15 and 2.3.16 respectively for: (All Failure Causes)
 - High speed GN2 spin
 - Hotfire
- o BITE test to verify electrical continuity of the speed sensors prior to on pad hotfire operations is performed per OMRSD File V, Vol. 1 requirement number B42AP0.050. (Electrical Open/Short Circuit)
- o APU BITE test is conducted per OMRSD File V, Vol. 1 requirement numbers B42AP0.050 and .060. (Electrical Open/Short Circuit)
- o BITE test to verify electrical continuity of the speed sensors is performed during final countdown (approximately 11 hours prior to launch) per OMRSD File V, Vol. 1 requirement numbers B42AP0.050 and .060. Last test of MPUs. (Electrical Open/Short Circuit)

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The above referenced OMRSD testing is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Vendor inspections and test records are verified per SIP 1128 by USBI QAR. (All Failure Causes)
- o Verification of material certifications is performed per SIP 1128 by USBI QAR. (Probe Failure Due to Material of Manufacturing Defects)
- o Verification of solder inspection of J1 and J7 speed sensor leads to interface connector per SIP 1128 by USBI QAR. (Electrical Open/Short Circuit)
- o Verification of all seals and sealing surfaces is performed per SIP 1128 by USBI QAR. (Contamination/Corrosion)
- o Witnessing of acceptance test is performed per SIP 1128 by USBI QAR. (All Failure Causes)

- o Verifications that are required on new units are performed on refurbished units per SIP 1128 by USBI QAR. (All Failure Causes)
- o Critical Processes/Inspections:
 - Welding per MIL-T-5021
 - Heating treat per WPS-171006
 - Brazing per MIL-B-7883
 - Soldering per CPO5.06-01

KSC RELATED INSPECTIONS

- o Proper function of TVC system is demonstrated during hotfire per 10REQ-0021, paras. 2.3.15 and 2.3.16 respectively for: (All Failure Causes)
 - High speed GN2 spin
 - Hotfire
- o Verification of MPU continuity during BITE is performed per OMRSD File V, Vol. 1 requirement number B42AP0.050. (Electrical Open/Short Circuit)
- o Verification of proper performance of BITE test is performed during launch countdown per OMRSD File V, Vol. 1 requirement number B42AP0.050. (Electrical Open/Short Circuit)
- o Verification of MPU operation is performed during BITE per OMRSD File V, Vol. 1 requirement number B42AP0.050. (All Failure Causes)
- o Verification of APU BITE test is performed per OMRSD File V, Vol. 1 requirement numbers B42AP0.050 and .060. (All Failure Causes)

D. FAILURE HISTORY

- o Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- o Not applicable to this failure mode.