SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Magnetic Pickups (Part of APU)

PART NO.: 5906050
5908322 (Alt)

FM CODE: A05

ITEM CODE: 20-01-22

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NUMBER REQUIRED: 4

DATE: March 1, 1995

CRITICAL PHASES: Boost

SUPERCEDES: November 6, 1989

FMEA PAGE NUMBER: A-69

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SHEET 1 OF 4

APPROVED: R. Ailor

FAILURE MODE AND CAUSES: Excessive output [Magnetic pickups MPU no. 1 and/or MPU no. 2] (Systems A and B) caused by:

- Low resistance to ground
- Loose MPU mounts
- Material defect
- Magnetized spacer

FAILURE EFFECT SUMMARY: Loss of TVC will result in loss of mission, vehicle and crew. One success path remains after the first failure. Operation is not affected until both paths are lost.

REDUNDANCY SCREENS AND MEASUREMENTS:

1) Pass - Units are subject to Sundstrand ATP TS2409, Rev. Y, during turnaround and refurbishment.

2) Fail - No independent verification of speed measurements.

3) Pass - No known common cause.

RATIONALE FOR RETENTION:

A. DESIGN

- The Magnetic Pickups are designed and qualified in accordance with end item specification 10SPC-0050. (All Failure Causes)

- 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. (Low Resistance To Ground)

- Material selection is per MSFC-SPEC-522A. (Material Defects)
- Qualification testing verified design requirements as reported in Sundstrand APU Qualification Test Report AER-1539-6 Rev B. (All Failure Causes)

B. TESTING

- Acceptance testing is performed per Sundstrand ATP TS2409 on all new units. This includes resistance checks, a GN2 spin, hotfire acceptance test, insulation current leakage test and electrical check. (All Failure Causes)
- During refurbishment and prior to reuse the APU and its components are subjected to the same ATP as new units per Sundstrand ATP TS2409. (All Failure Causes)
- BITE resistance test to verify electrical continuity of the speed sensors prior to hotfire operations is performed per 10REQ-0021, para. 2.3.4. (All Failure Causes)
- 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
- BITE resistivity test to verify electrical continuity of the speed sensors is performed during final countdown (Approximately eleven hours prior to launch) per OMRSD File V, Vol. 1 Requirement Numbers B42APO.050 and .060. Last test of MPUs. (All Failure Causes)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTIONS

- Source inspection plan verifies proper manufacturing and assembly. (All Failure Causes)
- Vendor inspections and test records are verified per SIP 1128 by USBI QAR. (All Failure Causes)
- Verification of material certification is performed per SIP 1128 by USBI QAR. (Material Defect)
- Witnessing of acceptance test is performed per SIP 1128 by USBI QAR. (All Failure Causes)
- Verifications that are required on new units are performed on refurbished units per SIP 1128 by USBI QAR. (All Failure Causes)

- Critical Processes/Inspections:

  - Demagnetization of bearing spacer per CP16.04-01

KSC RELATED INSPECTIONS

- 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

- Verification of proper performance of BITE resistivity test is performed per OMRSD File V, Vol. 1 Requirement Numbers B42APO.050 and .060. (Low Resistance To Ground)

D. FAILURE HISTORY

Criticality 1R

- Failure: Abnormal MPU traces during GN2 spin at ATP (PR SS0151 dated October, 1984).

  Cause: Residual magnetism in the bearing spacer.

  Corrective Action: None, this was considered an isolated event.

- Failure: At ATP low resistance to ground 378 vs. the required 380 ohms (PR SS089 dated April, 1982).

  Cause: Not defined.

  Corrective Action: None, due to the minor difference in actual vs. required resistance the condition was waivered by DAR B1-1228R1. .

- Failure: At ATP failed resistance checks (PR SS0236 dated March, 1986; SS0239 dated March, 1986).

  Cause: Salt water corrosion of coils due to heat degraded O-rings.

  Corrective Action: Sundstrand document changed to inspect O-rings, MPU leak check fixture modified to test the electrical connector seal and additional electrical tests (insulation resistance and dielectric withstanding voltage).

E. OPERATIONAL USE

- Not applicable to this failure mode.