SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Gas Generator

PART NO.:   5905078   FM CODE: A02
               Alt: 5905067
               Alt: 58727
               Alt: 5903456

ITEM CODE: 20-01-16   REVISION: Basic

CRITICALITY CATEGORY: 1   REACTION TIME: Seconds

NO. REQUIRED: 2   DATE: March 1, 2002

CRITICAL PHASES: Final Countdown, Boost   SUPERCEDES: March 31, 1999

FMEA PAGE NO.: A-58   ANALYST: R. Imre/ S. Finnegan

SHEET 1 OF 3   APPROVED: S. Parvathaneni

CN 044

FAILURE MODE AND CAUSES: Break in injector stem caused by:

o   Material Defect
o   Manufacturing Defect such as improper heat treat
o   Stress Corrosion cracking due to prolonged exposure to ammonium hydroxide and stresses above threshold values
o   Fatigue

FAILURE EFFECT SUMMARY: Fire and explosion will lead to the loss of mission, vehicle and crew.

REDUNDANCY SCREENS AND MEASUREMENTS: N/A

RATIONALE FOR RETENTION:

A. DESIGN

o   The Gas Generator is designed and qualified in accordance with end item specification 10SPC-0050. (All Failure Causes)

o   Gas generator injector stem strain and deflection are minimized during valve module installation. Final strain and deflection readings are used to determine stress by analysis. (All Failure Causes)

o   Maximum allowable (threshold) stress is 23,000 psi which is fifty percent of yield. (All Failure Causes)

o   Material selection is per MSFC-SPEC-522A. (All Failure Causes)

o   Injector stem material is Hastelloy B. Potential for stress corrosion cracking has been minimized by eliminating grain boundary precipitation of carbon. (All Failure Causes)

o   Qualification testing verified design requirements as reported in Sundstrand Qualification Test Report AER-1539-6 Rev. B. (All Failure Causes)

B.   TESTING

o   Acceptance testing is performed per General Dynamics OTS Aerospace ATP TP 0600 prior to installation in the APU. (All Failure Causes)   CN 044

o   Acceptance testing is performed per Sundstrand ATP TS 2409 on all new flight units. This includes a mission duty cycle hotfire and decontamination and precision cleaning of the fuel system. (All Failure Causes)

o   During refurbishment and prior to reuse, the gas generator is subjected to the same Sundstrand ATP standards as new units per TS 2409. (All Failure Causes)

o   TVC system functional test is performed during hotfire operations to demonstrate proper function per 10REQ-0021, para. 2.3.16. (All Failure Causes)

C.   INSPECTION

VENDOR RELATED INSPECTIONS

o   Source Inspection Plan verifies proper manufacturing and assembly per SIP 1491. (All failure causes)

o   Verification of proper operation per SIP 1491 by USA SRBE PQAR. (All Failure Causes)

o   Verification of injector stem stress measurements per SIP 1491 by USA SRBE-PQAR. (Stress Corrosion Cracking)

o   Verification of material certification per SIP 1491 by USA SRBE PQAR. (Material Defect)

o   Witnessing of acceptance test per SIP 1128 at Sundstrand and SIP 1491 at General Dynamics OTS Aerospace by USA SRBE PQAR. (All Failure Causes)   CN 044

o   Verifications that are required on new units are performed on refurbished units per SIP 1491 USA SRBE PQAR. (All Failure Causes)

o   Vendor inspections and test records are verified per SIP 1491 by USA SRBE PQAR. (All Failure Causes)

o   Critical Processes/Inspections:

  -   Welding per RRC-PS-0214
  -   Heat Treat per Proprietary Process
  -   Radiographic inspection per RRC-PS-0054
  -   Penetrant per RRC-PS-0244

<div align="center">KSC RELATED INSPECTIONS</div>

o   Proper function of TVC system is demonstrated during hotfire operations per 10REQ-0021 to include hotfire, para. 2.3.16. (All Failure Causes)

o   Inspect TVC system for damage - no leaks, signs of rubbing or discoloration are allowed per 10REQ-0021 following low speed GN2 spin, para. 2.3.11.3 and high speed GN2 spin, para. 2.3.15.5. (All Failure Causes)

o   Verification of post hot fire Nitrogen purge per 10 REQ-0021 para 2.3.16.5.b.2 (Stress Corrosion Cracking due to prolonged exposure to ammonia hydroxide)

D. FAILURE HISTORY

o   Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

o   Not applicable to this failure mode.