

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: APU Housings

PART NO.: 734560 (Turbine housing) FM CODE: A03
734561 (Exhaust housing)
(Part of 740416/734589(ALT.))

ITEM CODE: 20-01-28A REVISION: Basic

CRITICALITY CATEGORY: 1R REACTION TIME: Seconds

NUMBER REQUIRED: 2 DATE: March 31, 2000

CRITICAL PHASES: Final Countdown, Boost SUPERCEDES: March 1, 1995

FMEA PAGE NUMBER: A-93 ANALYST: C.J. Smith/S. Parvathaneni

SHEET 1 OF 4 APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: External leakage of hot gas at exhaust flange seal leakage test port. (System A and/or B) caused by:

- o Defective or damaged sealing surface
- o Improper torque
- o Improperly lockwired
- o Thread failure
- o Contamination

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

REDUNDANCY SCREENS AND MEASUREMENTS:

- 1) Fail - Redundancy cannot be verified during turnaround or refurbish-ment.
- 2) Fail - Undetectable loss of redundancy.
- 3) Fail - Contamination

RATIONALE FOR RETENTION

A. DESIGN

- o The APU Housing is designed and qualified in accordance with end item specification 10SPC-0050. (All failure causes)

- o Pressure cap and fitting material is Inconel 718 with resistoflex design for improved sealing upon application of operating pressure. (Defective or Damaged Sealing Surface, Thread Failure)
- o All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540. (Improper Torque, Improperly Lockwired)
- o A failure of primary duct flange E-seal is required in order for the port cap to be exposed to 5-7 psig hot exhaust gases. (Defective or Damaged Sealing Surface, Contamination)
- o E-seals are pressure and spring activated by design and also E-seals are silver and gold plated to enhance the seal. (Defective or Damaged Sealing Surface)
- o The aft skirt area is purged with GN2 prior to APU start up per OMRSD File II, Vol. 1, requirement number S00FM0.430. This reduces the O2 concentration to less than four percent. (All Failure Causes) CN 038
- 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 of APU and its components is performed per Sundstrand ATP TS 2409 on all new units. This includes a GN2 spin and hotfire. (Defective or Damaged Sealing Surface, Thread Failure)
- o During refurbishment and prior to reuse the APU is subjected to the same ATP as new units TS 2409. (Defective or Damaged Sealing Surface, Thread Failure)
- o The turbine exhaust system is leak checked with GN2 at 14 +1/-0 psig. Pressure leak greater than 2.5 psi in ten minutes is not acceptable per 10REQ-0021, para. 2.3.3.2. (Defective or Damaged Sealing Surface, Thread Failure)
- o Exhaust housing cavity is pressure tested before lockwiring to 15 ± 2 psig of helium and checked for pressure decay rate, from initial pressure, not to exceed (i) 1.0 psig/min for single leak and (ii) 1.5 psig/min for multiple leaks in 10 minutes per Sundstrand drawing 737722/1700061(Alt.). Normal exhaust pressure is 7-8 psig. (Defective or Damaged Sealing Surface, Thread Failure, Improper Torque).
- o TVC functional test is performed during hotfire operations to demonstrate proper function per 10REQ-0021, para. 2.3.16. (Defective or Damaged Sealing Surface, Thread Failure) CN 038

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Vendor inspection and test records are verified per SIP 1128 by USA SRBE PQAR. (All Failure Causes)
- o Verification of material certifications per SIP 1128 by USA SRBE. (Thread Failure)
- o Verification of all seals and sealing surfaces per SIP 1128 by USA SRBE. (Defective or Damaged Sealing Surface, Contamination)
- o Verification of torque operations per SIP 1128 by USA SRBE PQAR. (Improper Torque)
- o Witnessing of acceptance test per SIP 1128 by USA SRBE. (Defective or Damaged Sealing Surface, Thread Failure)
- o Verifications that are required on new units are performed on refurbished units, per SIP 1128 by USA SRBE PQAR. (All Failure Causes)
- o Verify threads per SIP 1128. (Thread failures)
- o Critical Processes/Inspections:
 - None

KSC RELATED INSPECTIONS

- o Performance of turbine exhaust system leak check per 10REQ-0021, para. 2.3.3.2. (Defective or Damaged Sealing Surface, Thread Failure)
- o Proper function of TVC system is demonstrated during hotfire to demonstrate proper function per 10REQ-0021, para. 2.3.16. (Defective or Damaged Sealing Surface, Thread Failure)
- o E-seals are inspected prior to installation for absence of physical defects per 10 REQ-0021 para 2.3.0. (Defective or Damaged Sealing Surface, Contamination)
- o Sealing surfaces are inspected by USA SRBE prior to installation verifying no contaminant or obstruction exists per 10REQ-0021 para 2.3.0. (Defective or Damaged Sealing Surface, Contamination)
- 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. (Defective or Damaged Sealing Surface, Thread Failure)
- o Post hotfire verification, including inspection and leak check per 10REQ-0021, para. 2.3.16.4. (Defective or Damaged Sealing Surface, Thread Failure)

D. FAILURE HISTORY

- o Criticality IR
- o Failure Histories may be obtained from the PRACA database

E. OPERATIONAL USE

- o Not applicable to this failure mode.