SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydrazine Flex Lines

PART NO.: 10200-0018-101/102 alt.
10201-0015-101
10201-0011-101

FM CODE: A01

ITEM CODE: 20-01-43

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 6

DATE: March 31, 2000 CN 038

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 1997 CN 038

FMEA PAGE NO.: A-139

ANALYST: B. Snook/S. Parvathaneni CN 038

SHEET 1 OF 5

APPROVED: S. Parvathaneni CN 038

FAILURE MODE AND CAUSES: External leakage of hydrazine (System A and/or B) caused by:

- Contamination
- Defective or damaged sealing surface
- Defective crimping
- Misalignment of dynatube sealing surface
- Improper torque
- Improperly lockwired

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

REDUNDANCY SCREENS AND MEASUREMENTS: N/A

RATIONALE FOR RETENTION:

A. DESIGN

- Dynatube fittings are titanium 6AL-4V and are attached to the hoses by mechanical swaging (Defective or damaged sealing surface)

- Flex lines consist of a fluoro-flex-T teflon base inner tube, two high tensile stainless steel spiral wraps, a teflon inner layer tape and an outer braid of 304 or 302 CRES. (Defective Crimping)

- All hydrazine lines are designed for proof pressure two times operating pressure and burst pressure four times operating pressure. (Defective or Damaged Sealing Surface and Defective Crimping)

- All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540 as applicable. (Improper Torque, Improperly Lockwired)

- Fluid procurement is controlled by SE-S-0073. (Contamination)

- Flex assemblies are fabricated per AM-B8510 and STP 303. This includes preparation and inspection of hose ends and fittings, assembly alignment checks and acceptance criteria of the assembled unit. Hose assemblies are mounted to the aft skirt in a class 100,000 clean room. (Contamination and Defective Crimping)

- Normal operating pressure of the fuel system is 400 psig maximum. (All Failure Causes)

- The aft skirt area is purged with GN2 prior to APU start up. This reduces the 02 concentration to less than four percent per OMRSD File II, Vol. 1, requirement number S00FM0.430. (All Failure Causes)

- Tubing and Hoses were qualified for SRB application as reported in the Solid Rocket Booster TVC System verification test (V-2) TM-78258 (nominal) and TM-82439 (off-nominal). (All failure causes)

B. TESTING

- Individual hose assemblies are hydrostatically proof tested per 10REQ-0021, para. 2.3.3.5. (Defective or Damaged Sealing Surface and Defective Crimping)

- Individual hose assemblies are helium leak tested per 10REQ-0021, para. 2.3.3.6. (Defective or Damaged Sealing Surface and Defective Crimping)

- Individual hose assemblies are precision cleaned by USA SRBE. (Contamination)

- Installed tube/hose assemblies are helium leak tested per 10REQ-0021, para. 2.3.3.1. (All Failure Causes)

- Helium is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board circuits per 10REQ-0021, para. 2.3.2.5. (Contamination)

- Hydrazine is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydrazine circuits per 10REQ-0021, para. 2.3.2.1 and OMRSD File V, Vol. 1, Requirement Number B42AP0.010. (Contamination)

- GN2 is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydrazine circuits per 10REQ-0021, para. 2.3.2.2 and OMRSD File V, Vol. 1, Requirement Number B42AP0.012. (Contamination)

- o GN2 (from MLP portable panels) is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydrazine circuits per OMRSD File V, Vol. 1, Requirement Number B42AP0.012. (Contamination)

- o Fuel circuit (system) passivation is performed per 10REQ-0021, para. 2.3.7.3. (All Failure Causes)

- o Functional test is performed during hotfire operations per 10REQ-0021, para. 2.3.11, 2.3.15, and 2.3.16 respectively for: (All Failure Causes)

  - Low speed spin
  - High speed spin
  - Hotfire

- o Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. I, requirement number B42APO.030 (All Failure Causes)

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Inspection of sealing surfaces by USA SRBE PQAR per SIP 1260. (Defective or Damaged Sealing Surface)

- o Critical processes/Inspections:

  - Crimping per STP 303

KSC RELATED INSPECTIONS

- o Hydrostatic test is verified per 10REQ-0021, para. 2.3.3.5. (Defective or Damaged Sealing Surface and Defective Crimping)

- o Hose assemblies cleanliness is verified by USA SRBE per 10REQ-0021-para. 2.3.0. (Contamination)

- o Assembly torque and lockwire are verified per 10REQ-0021, para. 2.1.4 during assembly. (Improper torque, Improperly Lockwired)

- o Fuel system leak test is performed per 10REQ-0021, para. 2.3.3.1. (All Failure Causes)

- o System pressure decay test is monitored per 10REQ-0021 para. 2.3.3.1.b for the fuel system prior to hot fire. (All failure causes)

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

- o Post hotfire inspection for evidence of leakage per 10REQ-0021, para. 2.3.16.4. (All Failure Causes)

- Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. I, requirement number B42APO.030 (All Failure Causes)

- Individual hose assemblies helium leak test verifies acceptable leakage per 10REQ-0021, para. 2.3.3.6. (Defective or Damage Sealing Surface and Defective Crimping)

- Assembly torque and lockwire are verified per 10REQ-0021, para. 2.1.4 during lower frame assembly. (Improper Torque, Improperly Lockwired)

- Inspect all tubing/hose assemblies, fittings and sealing surfaces prior to installation per 10REQ-0021, para. 2.3.0. (Defective or Damaged Sealing Surface, Defective Crimping)

- Torque and lockwiring of specific in skirt hydrazine hose installations are witnessed per 10REQ-0021, para. 2.1.4. (Improper Torque, Improperly Lockwired)

- Helium cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board circuits per 10REQ-0021, para. 2.3.2.5. (Contamination)

- Hydrazine cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydrazine circuits per 10REQ-0021, para. 2.3.2.1 and OMRSD File V, Vol. 1, Requirement Number B42AP0.010. (Contamination)

- GN2 cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydrazine circuits per 10REQ-0021, para. 2.3.2.2 and OMRSD File V, Vol. 1, Requirement Number B42AP0.012. (Contamination)

- Inspections for leaks, rubbing and discoloration are conducted per 10REQ-0021, para. 2.3.11.3 and 2.3.15.5 respectively, following low speed GN2 spin and high speed GN2 spin. (All Failure Causes)

- TVC Couplings (Both SRB and GSE) are inspected each time prior to mating per 10REQ-0021 para. 2.3. After transfer to SPC they are inspected prior to mating per File V, Vol. I, requirement number B42GEN.070. (Contamination).

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- GN2 (from MLP portable panels) cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydrazine circuits per OMRSD File V, Vol. 1, Requirement Number B42AP0.012. (Contamination)

- GN2 (from servicing cart) cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydrazine circuits per OMRSD File V, Vol. 1, Requirement Number B42AP0.012. (Contamination)

- Hydrazine (from servicing cart) cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydrazine circuits per OMRSD File V, Vol. 1, Requirement Number B42AP0.010. (Contamination)

D. FAILURE HISTORY

- Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- Not applicable to this failure mode.