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: A02

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-140

ANALYST: B. Snook/S. Parvathaneni CN 038

SHEET 1 OF 5

APPROVED: S. Parvathaneni CN 038

FAILURE MODE AND CAUSES: Rupture (System A and/or B) caused by:

- Material defect
- Manufacturing defect
- Improper installation

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. (Material Defects and Manufacturing Defects)

- Flex lines consist of a fluoroflex-T teflon base inner tube, two high tensile stailness steel spiral wraps, a teflon inner layer tape and an outer braid of 304 or 302 CRES. (Manufacturing Defects, Material Defects)

- All hydrazine lines are designed for proof pressure two times operating pressure and burst pressure four times operating pressure. (Material Defect, Manufacturing Defect)

- All threaded fittings and connectors are torqued to engineering specifications and lockwired per MS33540 as applicable. (Improper Installation)

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

- Tube assemblies are fabricated per 10PRC-0038 and hose assemblies are fabricated per AM-B8510 and STP 303. This includes preparation and inspection of tube/hose ends and fittings, assembly alignment checks and acceptance criteria of the the assembled unit. Tube/Hose assemblies are mounted to the aft skirt in a Class 100,000 clean room. (Manufacturing Defect)

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

- Lines are clamped down to prevent damage from excessive vibration. (Manufacturing Defects)

- The aft skirt 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)

- 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. (All Failure Causes)

- Fuel system leak test is witnessed per 10REQ0021 para 2.3.3.1. (All failure causes)

- Individual hose assemblies are helium leak tested per 10REQ-0021, para. 2.3.3.6. (All Failure Causes)

- Individual hose assemblies are precision cleaned by USA SRBE per 10REQ-0021, para. 2.3.0. (Manufacturing Defects)

- Installed tube/hose assemblies are helium leak tested per 10REQ-0021, para. 2.3.3.3. (Material Defect, Manufacturing Defect and Improper Installation)

- 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. (Material Defects)

- 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. (Material Defects)

- 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. (Material Defects)

- o 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. (Material Defect)

- o Fuel circuit (system) passivation is performed per 10REQ-0021, para. 2.3.7.3. (Material Defect)

- 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)

  - o Low speed spin
  - o High speed spin
  - o 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 Inspections of sealing surfaces by USA SRBE PQAR per SIP 1260. (Material Defects)

- o Critical processes/Inspections:

  - Swaging per STP 303

KSC RELATED INSPECTIONS

- o Hydrostatic test is verified per 10REQ-0021, para. 2.3.3.5. (All FailureCauses)

- o Individual tube assemblies helium leak test is verified per 10REQ-0021, para. 2.3.3.6. (All Failure Causes)

- o Assembly torque is verified per 10REQ-0021, para. 2.1.4. (Manufacturing Defects)

- o Lockwire is verified per 10REQ-0021, para. 2.1.4. (Improper Installation)

- o Fuel system helium 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 In skirt tube/hose installation torque and lockwire is witnessed per 10REQ-0021, para. 2.1.4. (Manufacturing Defects, Improper Installation)

- o 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. (Material Defect)

- o 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)

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

- o 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. (Material Defect).

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- o Proper function of TVC system is demonstrated during hotfire operations per 10REQ-0021, para. 2.3.11, 2.3.15, and 2.3.16 respectively for: (All Failure Causes)

  - Low Speed GN2 spin
  - High Speed GN2 spin
  - Hotfire

- o Post hotfire inspection and leak check per 10REQ-0021, para. 2.3.16.4.(All Failure Causes)

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

- o 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. (Material Defect)

- o Precision cleaning of tubes/hoses is verified by USA SRBE per 10REQ-0021 para. 2.3.0. (Material Defect)

- 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. (Material Defect)

- 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. (Material Defects)

- 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. (Material Defects)

D. FAILURE HISTORY

- Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- Not applicable to this failure mode.