SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydrazine Rigid Lines and Fittings

PART NO.: See Below

FM CODE: A01

ITEM CODE: 20-01-42

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: See Parts List

DATE: March 31, 1998

DCN 033
DCN 033
DCN 035

CRITICAL PHASES: Final Countdown and Boost

SUPERCEDES: March 31, 1997

FMEA PAGE NO.: A-137

ANALYST: B. Snook/S. Parvathaneni

SHEET 1 OF 6

APPROVED: P. Kalia

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

- Contamination
- Defective or damaged sealing surface
- Defective line swage
- Misalignment of dynatube sealing surfaces
- 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

PART NUMBERS:

Rigid Lines

Alt. 10200-0011-101
10200-0011-102
10200-0020-101
Alt. 10200-0020-105
10200-0020-109
Alt. 10200-0020-106
10200-0020-103
Alt. 10200-0020-107

10201-0002-104
10201-0002-106
10201-0002-114
10201-0002-115
10203-0003-101
10203-0004-102
10203-0005-105

Fittings

Connector
10209-0025-801 (2)

Tee
10209-0010-801
Alt. 10209-0117-801
10209-0053-801 (2)
Alt. 10209-0118-801

Elbow
10209-0068-801 (3)
Alt. 10209-0133-801
10209-0069-801
Alt. 10209-0134-801

RATIONALE FOR RETENTION:

A. DESIGN

- All lines are 304L stainless steel tubing per MIL-T-6845 or 3AL-2,5V Titanium tubing per 13A10047. (Defective Line Swage)

- Dynatube fittings are titanium 6AL-4V and are attached to the tubing by mechanical internal swaging. (Defective LineSwage)

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

- Fluid procurement is controlled by SE-S-0073. (Contamination)
- All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540 as applicable. (Improper Torque, Improperly Lockwired)
- Lines are clamped down to prevent damage from excessive vibration. (Misalignment of Dynatube Sealing Surfaces)
- Stainless steel tubing is not reused. (All Failure Causes)
- Tube and hose assemblies are fabricated per 10PRC-0038. This includes the preparation and inspection of tube/hose ends and fittings assembly alignment checks, and acceptance criteria of the assembled unit. Tube/ hose assemblies are mounted to the aft skirt in a 100,000 clean room. (All Failure Causes)
- Normal operating pressure of the fuel system is 400 psig maximum. (Defective or Damaged Sealing Surface)
- 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 S00PM0.430. (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 tube assemblies are hydrostatically proof tested per 10REQ-0021, para. 2.3.3.5. (Defective or Damaged Sealing Surface and Defective Line Swage)
- Individual tube assemblies are helium leak tested per 10REQ-0021, para. 2.3.3.6. (Defective or Damaged Sealing Surface and Defective Line Swage)
- Individual tube assemblies are precision cleaned by USBI per 10REQ-0021, para. 2.3.0. (Contamination)
- Installed tube/hose assemblies are helium leak tested per 10REQ-0021, para. 2.3.3.3. (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 During Assembly)

- 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)

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

- 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

- Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. 1, requirement number B42APO.030 (All Failure Causes)

C. INSPECTION

VENDOR RELATED INSPECTIONS

- Inspections of sealing surfaces by USBI QAR per SIP 1260. (Defective or Damaged Sealing Surface)

- Critical processes/inspections:

  - Swaging per 10PRC-0038
  - Tube Bending per 10PRC-0038
  - Tube End Flaring per 10PRC-0038

KSC RELATED INSPECTIONS

- Individual tube assemblies are inspected for the requirements of 10PRC-0038 per 10REQ-0021, para. 2.3.0. (All Failure Causes)

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

- Individual tube assemblies helium leak test verifies acceptable leakage per 10REQ-0021, para. 2.3.3.6. (Contamination, Defective or Damaged Sealing Surface and Defective Line Swage)

- Tube assemblies are precision cleaned by USBI per 10REQ-0021, para. 2.3.0. (Contamination)

- 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 Line Swage)

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

- In skirt tube/hose installation torque and lockwire is verified per 10REQ-0021, para. 2.1.4. (Improper Installation)

- 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)

- 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)

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

- Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. 1, requirement number B42APO.030 (All Failure Causes)

- Hydrazine system leak test is verified per 10REQ-0021, para. 2.3.3.1 and 2.3.3.6. (All Failure Causes)

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

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

D. FAILURE HISTORY

- Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- Not applicable to this failure mode.