SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fuel Isolation Valve (FIV)

PART NO.: 10201-0052-802 (Alt. for BI070 thru BI081 and mandatory BI082 and Subs)

FM CODE:A08

ITEM CODE: 20-01-10

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000 CN 038

CRITICAL PHASES: Final Countdown

SUPERCEDES: March 31, 1997 CN 038

FMEA PAGE NO.: A-20C

ANALYST: S. Gordon/S. Parvathaneni CN 038

SHEET 1 OF 4

APPROVED: S. Parvathaneni CN 038

FAILURE MODE AND CAUSES: External leakage of hydrazine at the leak checkport following leak through the Poppet/Bellows Assembly (System A and/or B) caused by:

- Improper Torque
- Thread Failure
- Defective or damaged O-ring
- Improperly Lockwired
- Defective or Damaged Sealing Surface
- Contamination

  and
- Fracture of the Poppet/Bellows Assy.
- Intergranular corrosion of the Poppet/Bellows Assy.

FAILURE EFFECT SUMMARY: External leakage of hydrazine in the Aft-Skirt can lead to fire and explosion leading to loss of mission, vehicle and crew.

REDUNDANCY SCREENS AND MEASUREMENTS:

- Fail - Not detectable during normal ground turnaround
- Fail - Not detectable by crew
- Fail - Contamination

RATIONALE FOR RETENTION:

A. DESIGN

- The Fuel Isolation Valve is designed and qualified in accordance with end item specification 10SPC-0056. (All failure causes)
- O-ring material is ethylene propylene and is selected for compatability to hydrazine. (Defective or Damaged O-ring)
- End Cap is a 304L series stainless steel (Defective or damaged sealing surface.)
- Aft Skirt area is purged with GN2 prior to APU start up, reducing the O_2 concentration to less than 4 percent per OMRSD File II, Vol. I requirement no. SOOFMO.430. (All Failure Causes)
- Qualification testing verified design requirements as reported in Consolidated Control Qualification Test Report QTR 1 and similarity report CE-ER-93-001 (COQ: A-TVC-4109-4). (All Failure Causes)
- Threaded fittings are 304L Cres. (Thread Failure)

B. TESTING

- Acceptance test is performed per 74740 ATP1 on the flight articles at vendor's plant. This includes a Visual Examination, Proof Pressure to 650 psig, and external leakage at 650 psig with maximum allowable leakage rate of 5×10^{-6} sccs of Helium Tests, Performance Checks, and helium leak check across poppet/bellows assy at 650 psig with maximum acceptable leakage rate of 5×10^{-6} sccs. (All failure causes)
- During refurbishment and prior to reuse, Fuel Isolation Valves are reworked per 10SPC-0131 and acceptance tested by USA SRBE/TBE Florida Operations per the criteria of 10SPC-0056 which includes helium leak check across Poppet/Bellows Assy at 675 ± 25 psig with maximum acceptable leakage rate of 5×10^{-6} sccs. (All Failure Causes)
- Hydrazine is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board flight hardware per 10REQ-0021, para. 2.3.2.1 and OMRSD File V, Vol. 1, requirement number B42APO.010. (Contamination)
- GN2 cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board flight hardware per 10REQ- 0021, para. 2.3.2.2 and OMRSD File V, Vol. 1, requirement number B42APO.012. (Contamination)
- Hotfire test is performed during hotfire operations to demonstrate proper function per 10REQ-0021, para. 2.3.16. (All failure causes)
- Helium is verified for cleanliness and composition (purity and particu- late count) prior to introduction to on-board flight hardware per 10REQ- 0021, para. 2.3.2.5. (Contamination)

- Verification of FSM bottle pressure for hydrazine system pressure check per File V, Vol. I, requirement number B42AP0.025. (All Failure Causes)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- Verification of O-ring inspection by USA SRBE PQAR per SIP 1204. (Defective or damaged O-ring)
- Material Certification is verified by USA SRBE PQAR per SIP 1204 (Defective or damaged O-ring, integraular corrosion of the Poppet/Bellows Assy).
- Sealing surfaces are verified per SIP 1204. (Defective or damaged sealing surface)
- Perform final inspection to drawing requirements per SIP 1204. (All failure causes)
- Witness Acceptance testing per SIP 1204 including the helium leakcheck across Poppet/Bellows Assy. (Fracture of Poppet/Bellows Assy, Intergranular corrossion of the Poppet/Bellows Assy., Defective or Damaged Sealing Surface, Contamination, Thread Failure.)
- Critical Processes/Inspections:
  - Passivation of bellows per MIL-S-5002C
  - Fusion Welding (Bellow Assembly) per SS-3012E
  - TIG Welding (poppet and shaft bellows assembly) per SS-3015
  - Heat Treat per QQ-S-763

II. KSC RELATED REFURBISHMENT INSPECTIONS

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- Visual inspection of FIV will be performed per 10SPC-0131, para. II. (All Failure Causes)
- Functional testing of FIV will be performed per 10SPC-0131, paragraph IV.

  All manual tests will be witnessed by Quality or verified for those instances when controlled software is utilized and a test report is generated. (All Failure Causes)

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- O-ring is replaced during refurbishment with a new one. (Defective or damaged O-ring)

III. KSC RELATED ASSEMBLY & OPERATIONS INSPECTIONS

- Witness the torque applied to critical TVC components per 10REQ-0021, para. 2.1.4. (Improper torque)
- Verify installation of lockwire as indicated by assembly drawing per 10REQ-0021, para. 2.1.4. (Improperly lockwired)

- o Proper function of TVC system is demonstrated during hotfire per 10REQ-0021, para. 2.3.16. (All failure causes)
- o Post hotfire verification, including inspections and leak checks per 10REQ-0021, para. 2.3.16.4. (All failure causes)
- o O-rings are inspected with 3X magnification prior to installation for absence of physical defects (cuts, voids, creases, flashing or burrs) per 10REQ-0021, para. 2.3.0. (Defective or damaged O-ring)
- o Sealing surfaces are inspected prior to installation verifying no contaminant or obstruction exists per 10REQ-0021, para. 2.3.0. (Defective or damage sealing surface)
- o Helium cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board flight hardware per 10REQ- 0021, para. 2.3.2.5. (Contamination)
- o Hydrazine cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board flight hardware per 10REQ- 0021, para. 2.3.2.1 and OMRSD File V, Vol. 1, requirement number B42AP0.010. (Contamination)
- o GN2 cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board flight hardware per 10REQ- 0021, para. 2.3.2.2 and OMRSD File V, Vol. 1, requirement number B42AP0.012. (Contamination)
- o Verification of fuel system pressure decay test is performed per 10REQ- 0021, para. 2.3.6 prior to hotfire. (All failure causes)
- o Inspect TVC system in aft skirt 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 FSM bottle pressure for hydrazine system pressure check per File V, Vol. I, requirement number B42AP0.025. (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 Fuel system leak test is performed per 10REQ-0021, para 2.3.6 (All failure causes)

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D. FAILURE HISTORY

Criticality Category 1R:

- o Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- o Not applicable to this failure mode.