

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fuel Isolation Valve (FIV)

PART NO.: 10201-0052-801 (FIV) FM CODE: A04  
(Effectivity BI062 thru BI081)  
10201-0052-802 (BI082 and Subs mand.,  
Alternate till BI081)  
(includes Isolation Mount  
Consolidated Control-76928  
10209-0015-802 (K-Seal)  
10209-0042-801 (Connector)

ITEM CODE: 20-01-10 REVISION: Basic

CRITICALITY CATEGORY: 1 REACTION TIME: Seconds

NO. REQUIRED: 2 DATE: March 31, 2000

CRITICAL PHASES: Final Countdown, Boost SUPERCEDES: March 31, 1998

FMEA PAGE NO.: A-19 ANALYST: B. Snook/ S. Parvathaneni

SHEET 1 OF 6 APPROVED: S. Parvathaneni

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

- o Improper Torque
- o Thread Failure
- o K-seal Failure
- o Improper Lockwired
- o Defective or Damaged Sealing Surface
- o Contamination
- o Improper mounting of Isolation mount fasteners

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

- o The Fuel Isolation Valve is designed and qualified in accordance with end item specification 10SPC-0056. (All failure causes)
- o Designed to show no visual evidence of external liquid leakage up to proof pressure. When tested with a mixture of ninety percent N<sub>2</sub> and ten percent He gases, leakage shall not exceed  $1 \times 10^{-4}$  sccs of He. (Defective or damaged sealing surface)

- o Valve body is a 300 series stainless steel (79,000 lb/in<sup>2</sup> tensile). (Defective or damaged sealing surface)
- o Operating pressure is 430 psig, proof pressure is 650 psig, and burst pressure is 1600 psig. (Thread failure)
- o MS type boss ports are used for both inlet and outlet with teflon coated stainless steel K-seals between dynatube adapter fittings and boss ports. K-seals are compatible with the liquid hydrazine environment. (K-Seal failure and defective or damaged sealing surface)
- o The Aft Skirt area is purged with GN2 prior to APU start up, reducing the O2 concentration to less than four percent per OMRSD File II, Vol. 1, requirement number S00FMO.430. (All failure causes)
- o Qualification testing verified design requirements as reported in Consolidated Control Qualification Test Report 74740 QTR 1. (All failure causes)
- o Threaded fittings are 304L Cres. (Thread failure)
- o Inlet and outlet fitting surfaces are cleaned and protected per consolidated controls document 74740 CSI. (Defective or damaged sealing surface)
- o All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540 as applicable. (Improperly lockwire, improper torque)
- o Fluid procurement is controlled by SE-S-0073. (Contamination)
- o Valve is cleaned and cleanliness maintained during assembly per Consolidated Controls specification 74740 CS1. (Contamination)

#### B. TESTING

- o Acceptance test is performed per Consolidated Controls ATP 74740 ATP 1 on the flight articles at vendor's plant. This includes a Visual Examination, Proof Pressure to 650 + 50/-0 psig and external leakage  $\leq 5 \times 10^{-6}$  sccs of Helium Tests, and Cleanliness Verification. (All failure causes)
- o During refurbishment and prior to reuse, Fuel Isolation Valves including the Isolation Mounts are reworked per 10SPC-0131 and acceptance tested by USA SRBE/TBE Florida Operations per the criteria of 10SPC-0056. This includes visual examination, cleanliness verification, proof pressure to 675  $\pm$  25 psig and external leakage  $\leq 1 \times 10^{-4}$  sccs of Helium Tests. (All failure causes)
- o Fuel system leak check is performed with helium to 380 +0/-10 psig, leaks in excess of  $1 \times 10^{-6}$  sccs are not acceptable per 10REQ-0021, para. 2.3.3.1. (All failure causes)

- o 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 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 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)
- o Hotfire test is performed during hotfire operations to demonstrate proper function per 10REQ-0021, para. 2.3.16. (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 GN2 (from MLP portable panels) is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board flight hardware per OMRSD File V, Vol. 1, Requirement Number B42AP0.012. (Contamination)
- o Helium is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board flight hardware per 10REQ-0021, para. 2.3.2.5. (Contamination)

The above referenced OMRSD testing is performed every flight.

## C. INSPECTION

### I. VENDOR RELATED INSPECTIONS

- o Verification that all parts are inspected for surface finish, burrs, damage and contamination by USA SRBE PQAR per SIP 1204. (Defective or damaged sealing surface)
- o Witness assembly and verify operation of valve by USA SRBE PQAR as below: (Improper torque, defective or damaged sealing surface and thread failure)
  - Pressure Records - SIP 1204.
  - Torque - SIP 1204.
  - Switch Settings - SIP 1204.
  - Solder Inspect Operations - SIP 1204.
  - Potting Cure Time - SIP 1204.
  - External Welds - SIP 1204
- o Perform final inspection to drawing requirements by USA SRBE PQAR per SIP 1204. (All failure causes)
- o Witness acceptance testing of FIV by USA SRBE PQAR per SIP 1204. (All failure causes)

- o Perform post ATP inspection of sealing surfaces to the inlet and outlet ports prior to packaging by USA SRBE PQAR per SIP 1204. (Defective or damaged sealing surface)
- o Refurbishment requirements are verified by USA SRBE PQAR per SIP 1204. (All failure causes)
- o Critical Processes/Inspections: - None

II. KSC RELATED REFURBISHMENT INSPECTIONS

CN 038

- o Visual inspection of FIV/Isolation Mounts will be performed per 10SPC-0131, para. II. (All Failure Causes)
- o Functional testing of FIV/Isolation Mounts 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)

CN 038

III. KSC RELATED ASSEMBLY & OPERATIONS INSPECTIONS

- o Cleanliness of FIV and attach tubing and/or hoses is verified by USA SRBE PQAR per 10REQ-0021, para. 2.3.0. (Contamination)
- o Witness the torque applied to critical TVC components per 10REQ-0021, para. 2.1.4. (Improper torque)
- o Verify installation of lockwire as indicated by assembly drawing per 10REQ-0021, para. 2.1.4. (Improperly lockwired)
- o Fuel system leak check is performed per 10REQ-0021, para. 2.3.3.1. (All failure causes)
- 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, K-Seals and E-Seals (as applicable) are inspected prior to installation for absence of physical defects per 10REQ-0021, para. 2.3.0. (K-seal failure)
- o Sealing surfaces are inspected prior to installation verifying no contaminant or obstruction exists per 10REQ-0021, para. 2.3.0. (Defective or damaged 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 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)
- 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 GN2 (from MLP portable panels) is verified for cleanliness and composition (purity and particulate count) prior to introduction on-board hydrazine circuits per OMRSD File V, Vol. 1, requirement number B42AP0.012. (Contamination)
- o GN2 (from servicing cart) 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 Hydrazine (from servicing cart) is verified for cleanliness and composition (purity and particulate count) are verified prior to introduction on-board hydrazine circuits per OMRSD File V, Vol. 1, requirement number B42AP0.010. (Contamination)
- o Verification of FSM bottle pressure for hydrazine system pressure check per File V, Vol. I, requirement number B42AP0.025. (All Failure Causes)
- 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. (All Failure Causes).

CN 038

D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.