

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fuel Isolation Valve

PART NO.: 10201-0052-801 (Eff. BI062 thru BI081)  
10201-0052-802 (BI082 and Subs Mand.,  
Alt. until BI081)  
Includes:  
Bellows75232-1  
Isolation Mount 76928  
Plunger75263

FM CODE: A02

ITEM CODE: 20-01-10

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000

CRITICAL PHASES: Boost

SUPERCEDES: March 31, 1997

FMEA PAGE NO.: A-17

ANALYST: B. Snook/S. Parvathaneni

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APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: Fails to remain open (System A and B) caused by:

- o Electrical open circuit (connector, wiring, solenoid)
- o Bellows failure
- o Isolation mount failure
- o Solenoid plunger thread failure
- o Contamination
- o Spool seal failure

FAILURE EFFECT SUMMARY: Failure of valves to remain open during boost will result in loss of TVC which leads to vehicle break up and loss of mission, vehicle and crew. One success path remains after the first failure. Operation is not affected until both paths are lost.

REDUNDANCY SCREENS AND MEASUREMENTS:

- 1) Pass - ATP-74740 at vendor's plant and acceptance per criteria of 10SPC-0056 at USA SRBE/TBE Florida Operations.
- 2) Pass - FIV position measurements, B46X1851X, B46X1852X.
- 3) Fail - Contamination

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 Valve is designed to preclude malfunction or inadvertent completion of electrical circuits by conducting or nonconducting fluid debris by isolation of electrical circuits and hydrazine. (Electrical Open Circuit)
- o Bellows are 350 CRES and are acceptance tested by Consolidated controls per ST-122, Rev. Basic. (Bellows Failure)
- o Solenoid plunger threads are per MIL-S-7742 and material selection per MSFC-SPEC-522A, ARMCO ingot iron. (Solenoid Plunger Thread Failure)
- o Valve is designed and is tested for 1000 cycles minimum life. (Bellows Failure)
- o Qualification testing verified design requirements as reported in Consolidated Controls Qualification Test Report 74740 QTR-1, Rev. A. (All Failure Causes)
- o Material selections are per JSC-SE-R-0006, Rev. A. (Isolation Mount Failure, Solenoid Plunger Thread Failure)
- o FIV isolation mount is subjected to vibration spectra testing prior to acceptance by Consolidated Controls per SP-1040; Rev. Basic. (Isolation Mount Failure)
- o Material selections are per MSFC-SPEC-522A. (Isolation Mount Failure, Solenoid Plunger Thread Failure, Spool Seal Failure)
- o Bellows shaft is 304L CRES condition A and all parts show a positive margin of safety per Consolidated Controls Stress Analysis Report 74740 SAR 3. (Bellows Failure)
- o Poppet is 355 CRES with a diameter range of 0.0005 inches (Effectivity thru BI081 as alternate) and is 350 CRES (Effectivity BI082 and Subs, Mandatory). (Material Defects)
- o Sleeve is teflon, 15 percent glass filled with a diameter +0.0015, -0 inch and is stress relieved. (Bellows Failure)

#### B. TESTING

- o Acceptance testing is performed per Consolidated Controls Corporation ATP 74740 ATP 1 on each the flight article at vendor's plant. This includes Visual Examination, Electrical Tests, Position Indicator Checks, Performance Checks, 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 per the criteria of 10SPC-0056 by USA SRBE/TBE Florida operations. This includes visual examination, cleanliness verification, electrical tests, isolation mount deflection tests, position indicator checks and performance checks. (All Failure Causes)

- o Acceptance testing on FIV isolation mount is performed at vendor's plant per Barry Controls ATP DSW404. This includes examination of product and dynamic test. (Isolation Mount failure)
- 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 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)
- o Electrical and functional tests are performed per 10REQ-0021, para. 2.3.4.3, and 2.3.15.2. (All Failure Causes)
- o TVC system functional test is performed during Hot Fire operations per 10REQ-0021, para. 2.3.16. (All Failure Causes)
- o FIV is functionally tested at bearing soak per OMRSD File V, Vol. 1 Requirement Number B42AP0.080. (All Failure Causes)
- o The last functional test of FIV operations is per OMRSD File II, Vol. 1, requirement number S00FR0.070. (All Failure Causes)

The above referenced OMRSD testing is performed every flight.

## C. INSPECTION

### I. VENDOR RELATED INSPECTION

- o Verification that all parts are inspected for surface finish, burrs, damage and contamination by USA SRBE PQAR per SIP 1204. (Solenoid Plunger Thread Failure, Bellows Failure, Contamination)
- o All material certifications are verified by USA SRBE PQAR per SIP 1204. (Bellows Failure)
- o Witness assembly and verify operation of valve by USA SRBE PQAR SIP 1204 as below: (All Failure Causes)
  - Pressure Records
  - Switch Setting
  - Solder Inspect Operations
  - Potting Cure Time
  - External Welds
- o Perform final inspection to drawing requirements 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. (Bellows Failure)
- o Witness acceptance testing of FIV by USA SRBE PQAR per SIP 1204. (All failure Causes).

- o Verification of material certification, vendor inspection and test records of FIV isolation mounts per USA SRBE PQAR per SIP 1288. (Isolation Mount Failure)
- o Witnessing of acceptance testing of FIV Isolation Mount per SIP 1288. (Isolation Mount Failure)
- o CRITICAL PROCESSES/INSPECTIONS:
  - Etching Wires per S-3079
  - Solder per NHB5300.4(3A-1), EVAD S-3486.
  - Weld per MIL-W-8611A
  - Heat Treat per AMS 2404

II. KSC RELATED REFURBISHMENT INSPECTIONS

- 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)

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III. KSC RELATED ASSEMBLY AND OPERATIONS INSPECTIONS

- o Proper function of TVC system is demonstrated during hotfire per 10REQ-0021, para. 2.3.16. (All Failure Causes)
- 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 B42APO.010. (Contamination)
- o Verification of proper valve operation during BITE per OMRSD File V, Vol. 1 Requirement Number B42APO.050. (All Failure Causes)
- o Verification of proper performance of BITE test by launch team per OMRSD File V, Vol. 1 Requirement Number B42APO.050. (All Failure Causes)
- o Fuel system leak test is performed per 10REQ-0021, para 2.3.6 (All failure causes)

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D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.

F. WAIVERS

- o (Waivers BI-1804R1 retired per CRBD SB5-90-H532A)