

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Single Mission Fuel Isolation Valve (SMFIV)

PART NO.: 10201-0122-801 FM CODE: A05  
(Alt. for BI109 and BI110,  
Mandatory for BI111 and Subs.)

ITEM CODE: 20-01-10A REVISION: Basic

CRITICALITY CATEGORY: 1 REACTION TIME: Seconds

NO. REQUIRED: 2 DATE: April 1, 2001

CRITICAL PHASES: Final Countdown, Boost SUPERCEDES:

FMEA PAGE NO.: A-20J ANALYST: G. Hoskins/S. Finnegan

SHEET 1 OF 4 APPROVED: S. Parvathaneni

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

- o Internal leakage of hydrazine into the coil and/or connector housing areas
- o Material defect
- o Manufacturing defect

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-0240. (All failure causes)
- o Design operating pressure is 430 psi, burst pressure 1300 psi. (All failure causes)
- o Valve body is a Aluminum Alloy 6061-T6 or T651. (Material Defect)
- o Manifold is Titanium, Type 6AL-4V. (Material Defect)
- o Core is CRES 430, magnetic iron. (Material Defect)
- o Material selection is per MSFC-SPEC-522A. (Material defect)
- o Valve will relieve outlet overpressure (exceeding 40-280 psi) to inlet, to equalize pressure differential. (Material defect)
- 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 S00FM0.430. (All failure causes)
- o Valve is designed and is tested for 20 valve cycles minimum life (One SRB mission). (All Failure Causes)

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- o Qualification testing verified design requirements as reported in Moog Inc. Qualification Test Report MR T-10241. (All failure causes)

## B. TESTING

- o Acceptance testing is performed per Moog Inc. ATP M RA-9480 on the flight articles at vendor's plant. This includes Visual Examination, Proof Pressure to 650 + 50/-0 psig and external leakage <math>1 \times 10^{-4}</math> sccs Helium Tests, Performance Checks, Closed Forward Check, Internal Leakage <math>\leq 5 \times 10^{-3}</math> sccs Helium and Cleanliness Verification. (All failure causes)
- o Penetrant inspection is performed on welds during manufacturing per Moog Inc. EP 3565. (Manufacturing defect)
- o GSE used to pressurize the fuel system has multiple relief valves set at 440 psig. (All failure causes)
- o Fuel system leak check is performed with helium at 430 to 480 psig, verifying no leaks in excess of  $1 \times 10^{-4}$  sccs per 10REQ-0021, para. 2.3.3.1 (Manufacturing defects)
- o Fuel circuit passivation verification is performed per 10REQ-0021, para. 2.3.7.3 on newly assembled systems and those whose integrity is invalidated for component replacement. (Material defect)
- 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 APU Bite resistance test B42AP0.050 and Frequency Bite test B42AP0.060 per File V, Vol. I, at T-9 hours, provides confidence that the coil assembly of the fuel isolation valve is not degraded by the exposure to hydrazine. (Internal Leakage of hydrazine to the electrical components.)

The above referenced OMRSD testing is performed every flight.

## C. INSPECTION

### I. VENDOR RELATED INSPECTIONS

- o Verification that material certifications meet the requirements called for on drawings and USA-SRB Element Purchase Order by USA SRBE PQAR per SIP 1511. (Material defect)

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- o Verification of data and supplier acceptance of the following by USA SRBE PQAR. (Material defect, manufacturing defect)
  - Heat Treat/Annealing - SIP 1511.
  - Nickel Plate with co-deposited Teflon coating – SIP 1511.
  - EB Welding - SIP 1511.
- o Witness acceptance testing in which measurements and/or readings are manually taken and/or recorded for the first two units in each test lot of FIV by USA SRBE PQAR per SIP 1511. Monitor acceptance testing for all other units in each test lot. (All failure causes)
- o Critical Processes/Inspections:
  - Annealing (Coil Housing, Core) per EP 3388
  - Passivation (Coil Housing, Core, Insulator) per EP 3204
  - EB Welding (Insulator-to-Coil Housing, Insulator-to-Core, End Cap) per EP 3406
  - Penetrant per EP 3254
  - Heat Treat per per EP 3233
  - Magnetic Particle Inspection per EP 3565
  - Eddy Current Inspection per EP 3812
  - Chromic Anodize per MIL-A-8625, Type 1, Class 1

## II. KSC RELATED REFURBISHMENT INSPECTIONS

- o N/A

## III. KSC RELATED ASSEMBLY AND OPERATIONS INSPECTIONS

- o Fuel system leak check is performed per 10REQ-0021, para. 2.3.3.1. (Material defect, manufacturing defect)
- 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 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 Inspections 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 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. (Material defect).
- o Verification of FSM bottle pressure for hydrazine system pressure check per File V, Vol. I, requirement number B42AP0.025. (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.

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