SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fuel Filter

PART NO.: 10203-0016-801 (Fuel Filter)
10209-0015-802 (K-Seal)
10209-0042-801 (Connector)

FM CODE:A03

ITEM CODE: 20-01-08

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000 CN 038

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 1997 CN 038

FMEA PAGE NO.: A-13

ANALYST: B. Snook/ S. Parvathaneni CN 038

SHEET 1 OF 5

APPROVED: S. Parvathaneni CN 038

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

- o Improper Torque
- o Defective or damaged sealing surface
- o Thread Failure
- o Contamination
- o K-seal Failure
- o Improperly Lockwired

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 Filter is designed per source control drawing 10203-0016 and is qualified in accordance with end item specification 10SPC-0049. (All failure causes)

- o The filter has an MS33649 boss port on each end. (Defective or damaged sealing surface)

- o Titanium dynatube fittings are used at the boss ports for connecting tubing. (Defective or damaged sealing surface)

- o Teflon coated, 304 stainless steel K-seals are installed between the dynatube fittings and the boss ports. The K-seals are compatible with the hydrazine environment. (K-Seal failure)

- All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540 as applicable. (Improperly lockwired, improper torque)

- Fluid procurement is controlled per SE-S-0073. (Contamination)

- The Aft Skirt area is purged with GN2 prior to APU startup, reducing the oxygen concentration to less than four percent per OMRSD File II, Vol. 1, requirement number S00FMO.430. (All failure causes)

- Qualification testing verified design requirements, as reported in ARDE Qualification Test Report QA41006-19. (All failure causes)

B. TESTING

- Acceptance test is performed per Wintec ATP 15228-591 on each new flight article. This includes Bubble Point Test, Visual Inspection, Proof Pressure Test to 800 psig, Leakage Test to $\leq 1 \times 10^{-6}$ sccs of helium, FlowTest and Cleanliness Verification of no metallic particles >100 microns.(All failure casues)

- During refurbishment and prior to reuse, the fuel filter is reworked per 10SPC-0131 and acceptance tested by USA SRBE/TBE Florida operations per the criteria of 10SPC-0049. This includes Visual Examination, Bubble Point Test, Proof Pressure Test to 650 psig min. for 1.0 minutes with no evidence of external leakage or failure or permanent deformation, external leakage $\leq 1.0 \times 10^{-4}$ SCCS of helium when pressurized to 455 ± 25 psig for 5 minutes and cleanliness verification (no particles > 100 microns) (All failure causes)

- 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)

- A fuel system leak check is verified with helium at 380 +0/-10 psig. Leaks in excess of 1×10^{-6} sccs are not acceptable, per 10REQ-0021, para. 2.3.3.1. (All failure causes)

- 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)

- 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)

- 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)

- Hotfire test demonstrates proper function of the TVC system 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 Verification of FSM bottle pressure for hydrazine system pressure check per File V, Vol. I, requirement number B42AP0.025. (All Failure Causes)

- o The above referenced OMRSD testing is performed every flight.

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- o Verification of material test report by USA SRBE PQAR per SIP 1213. (Defective or damaged sealing surfaces)

- o Filter dimensions are verified by USA SRBE PQAR per SIP 1213. (Defective or damaged sealing surface)

- o Acceptance testing is witnessed by USA SRBE PQAR per SIP 1213. (All Failure Causes)

- o Final inspection per drawing requirements by USA SRBE PQAR per SIP 1213. (All failure causes)

- o Verification of thread connections by USA SRBE PQAR per SIP 1213, para. 5.2. (Thread failure)

- o Cleanliness requirements are verified by USA SRBE PQAR per SIP 1213. (Contamination)

  NOTE: Inspections per SIP 1213 are performed on USA SRBE procured filters only. Filter procured by ARDE undergo verification by USA SRBE that all tests and inspection were performed per SIP 1110.

- o Critical Processes/Inspections:

  - TIG Welding of Fittings per WSF-008-321

II. KSC RELATED REFURBISHMENT INSPECTION

CN 038

- o Visual inspection of Fuel Filter will be performed per 10SPC-0131, para. II. (All Failure Causes)

- o Functional testing of Fuel Filter 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 AND OPERATIONS INSPECTION

- 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)

- Prior to installation sealing surfaces are inspected to verify that no contaminant or obstruction exists per 10REQ-0021, para. 2.3.0. (Defective or Damaged Sealing Surface, Contamination)

- Prior to installation all tube and hose assemblies, fittings and sealing surfaces are inspected per 10REQ-0021, para. 2.3.0. (Defective or Damaged Sealing Surface, Contamination, K-Seal Failure)

- Proper installation of lockwire as indicated by assembly drawing is verified per 10REQ-0021, para. 2.1.4. (Improperly lockwired)

- Witness of proper torque applied to critical TVC components is verified per 10REQ-0021, para. 2.1.4. (Improperly Torque)

- A fuel system leak check after installation is verified per 10REQ-0021, para. 2.3.3.1. (All failure causes)

- Proper function of the TVC system is witnessed during hotfire test per 10REQ-0021, para. 2.3.16. (All failure causes)

- Post hotfire verification, including leak checks is per 10REQ-0021, para. 2.3.16.4. (All failure causes)

- Precision cleaning of tubes/hoses is verified by USA SRBE per 10REQ-0021-2.3.0. (Contamination)

- 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)

- 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)

- 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)

- 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)

- Inspection of TVC system in aft skirt for damage (no leaks, signs of rubbing or discoloration 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)

- 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)

- 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. (Defective or Damaged Sealing Surface, Contamination)

CN 038

- 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) prior to introduction to 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)

D. FAILURE HISTORY

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

E. OPERATIONAL USE

- O Not applicable to this failure mode.