

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fuel Pump Assembly

PART NO.: 740412/734579 (Alt)
(Part of 10201-0049)

FM CODE: A05

ITEM CODE: 20-01-11

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 1997

FMEA PAGE NO.: A-25

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SHEET 1 OF 6

APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: External leakage of hydrazine (System A and/or B) at any one of five primary and secondary O-rings caused by:

- o Poppet Spring Failure (QD)
- o Defective or damaged O-ring
- o Defective or damaged sealing surfaces
- o Contamination
- and -
- o Defective or damaged o-ring
- o Defective or damaged sealing surface
- o Contamination
- o Improper torque
- o Thread failure

FAILURE EFFECT SUMMARY: Fire and explosion will lead to 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) Fail - Not detectable during normal ground turnaround.
- 2) Fail - Not readily detectable by flight or ground crew.
- 3) Fail - Contamination.

RATIONALE FOR RETENTION:

A. DESIGN

- o The Fuel Pump Assembly is designed and qualified in accordance with end item specification 10SPC-0050. (All failure causes)
- o The filter bowl drain quick disconnect is 300 series stainless steel (80,000 lb/in² tensile) with a Rosan Boss fitting for connection to the fuel pump housing. (Defective or Damaged Seal Surface)
- o O-ring material is ethylene propylene and is selected for compatibility with hydrazine. (Defective or Damaged O-Ring)
- o Poppet spring loads poppet to closed position. (Poppet Spring Failure)
- o Poppet spring is passivated 17-7 PH CRES. (Poppet Spring Failure)
- o Threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540. (Improper Torque, Improperly Lockwired) (BI-1803R2)
- o APU surfaces exposed to hydrazine, except gas generator, are cleaned per 10PRC-0339. (Contamination)
- o Hydrazine is filtered through a 25 micron filter upstream of the fuel pump. (Contamination)
- o Fluid procurement is controlled per SE-S-0073. (Contamination)
- o Aft skirt area is purged with GN2 prior to APU start up reducing O2 concentration to less than four percent per OMRSD File II, Vol. 1, requirement number S00FM0.430. (All Failure Causes)
- o Qualification testing verified design requirements as reported in Sundstrand Qualification Test Report AER-1539-6 Rev. B. (All Failure Causes)

B. TESTING

- o Supplier (Symetrics) tested Quick Disconnect to 2250 psig proof pressure and 3750 psig burst pressure, for a safety factor of 1.5 and 2.5 respectively. (Poppet Spring Failure, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Contamination, Thread Failure)
- o Acceptance testing is performed per TS2409 on new units. This includes a leak check of the entire fuel pump assembly at 100 ± 25 psig helium, fuel pump shaft seal leak at 350 ± 50 psig, GN2 spin, hot fire functional test, post hotfire pump shaft seal leak check at 350 ± 50 psig and decontamination and precision cleaning of APU fuel system. (All failure causes)

- o During refurbishment and prior to reuse, the fuel pump assembly is subjected to the same acceptance test as new units per TS-2409, after precision cleaning. (Poppet Spring Failure, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Contamination, Thread Failure)
- o Helium (Influent) is verified for cleanliness and composition (purity and particulate count) prior to fuel pump shaft seal leak check per 10REQ-0021, para. 2.3.2.5. (Contamination)
- o Helium is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board circuits per 10REQ-0021, para. 2.3.2.5. (Contamination)
- o Hydrazine is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydrazine circuits per 10REQ-0021, para. 2.3.2.1 and OMRSD File V, Vol. 1 requirement number B42AP0.010. (Contamination)
- o GN2 is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydrazine circuits per 10REQ-0021, para. 2.3.2.2 and OMRSD File V, Vol. 1 requirement number B42AP0.012. (Contamination)
- o GN2 (from MLP portable panels) is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydrazine circuits per 10REQ-0021, para. 2.3.2.2. (Contamination)
- o Proper TVC system functional test is performed during hotfire operations per 10REQ-0021 para. 2.3.16. (Poppet Spring Failure, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Thread Failure)
- o Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. I, requirement number B42APO.030. (Poppet Spring Failure, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Thread Failure)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Vendor inspection and test records are verified per SIP 1128 by USA SRBE PQAR. (All Failure Causes)

- o Verification of inspection of O-ring per SIP 1128 by USA SRBE PQAR. (Defective or Damaged O-Ring)
- o Material certifications are verified per SIP 1128 by USA SRBE PQAR. (Poppet Spring Failure, Defective or Damaged O-Ring, Thread Failure)
- o Seals and sealing surfaces are verified per SIP 1128 by USA SRBE PQAR. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface)
- o Verification of Sundstrand buy off of all torque operation per SIP 1128 by USA SRBE PQAR. (Improper Torque)
- o Acceptance testing is witnessed per SIP 1128 by USA SRBE PQAR. (Poppet Spring Failure, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Contamination, Thread Failure)
- o Verifications that are required on new units are performed on refurbished units, by USA SRBE PQAR, per SIP 1128. (All Failure Causes)
- o Verification of threads per SIP 1128. (Thread failures)
- o Critical Processes/Inspections:
 - Heat treat spring per MIL-H-6088.

KSC RELATED INSPECTIONS

- o Helium (Influent) cleanliness and composition (purity and particulate count) are verified prior to fuel pump shaft seal leak check per 10REQ0021, para. 2.3.2.5. (Contamination)
- o Precision cleaning of tubes/hoses is verified by USA SRBE per 10REQ-0021, para. 2.3.0. (Contamination)
- o Helium cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board circuits 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 hydrazine circuits 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 hydrazine circuits per 10REQ-0021, para. 2.3.2.2 and OMRSD File V, Vol. 1, requirement number B42AP0.012. (Contamination)
- o Proper function of TVC system is demonstrated during Hotfire operations per 10REQ-0021, para. 2.3.16 to include Hotfire. (Poppet Spring Failure, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Thread Failure)
- o Inspections for leaks, rubbing and discoloration are conducted per 10REQ-0021, para. 2.3.11.3 and 2.3.15.5 respectively, following low speed GN2 spin and high speed GN2 spin. (Poppet Spring Failure, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Thread Failure)
- o Post hotfire inspections and leak check per 10REQ-0021, para. 2.3.16.4.(Poppet Spring Failure, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Thread Failure)

- o GN2 (from MLP portable panels) cleanliness and composition (purity and particulate count) are verified 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. (Contamination).
- o GN2 (from servicing cart) cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydrazine circuits per OMRSD File V, Vol. 1 requirement number B42AP0.012. (Contamination) CN 038
- o Hydrazine (from servicing cart) cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydrazine circuits per OMRSD File V, Vol. 1 requirement number B42AP0.010. (Contamination)
- o Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. I, requirement number B42APO.030 (Poppet Spring Failure, Defective or Damaged O-ring, Defective or Damaged Sealing Surfaces, Thread Failure)

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 BI-1803-R3, dated 1-17-92, Level III approval SB3-01-4355
 - o Requirement: 10CEI-0001, Rev. J, para. 3.3.6.18 states that all threaded parts shall be positively locked. The lockwiring of fittings to be done per MS 33540.
 - o Departure from the Requirement: Symetric Quick Disconnect Cap of Filter Bowl Drain QD is not positively lockwired.
 - o Rationale for approval of the Waiver: This QD cap is not configured for lockwiring. QD caps were qualified to the present configuration including flight vibration, thermal shock and flight environment temperature requirements. QD caps are tethered, therefore no debris is generated. No flight history exists from thirty two (32) flights of items untorquing during flight or splashdown. The vendor has been directed to provide a positive locking feature for the QD cap.