

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fuel Pump Assembly

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

FM CODE: A03

ITEM CODE: 20-01-11

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 1997

FMEA PAGE NO.: A-23

ANALYST: R. Imre/ S. Parvathaneni

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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 fitting O-rings or one fuel pump/gearbox (shaft seal cavity) O-ring or any one of two plugs (for thread failure only) caused by:

- o Defective or damaged o-rings
- o Improper torque
- o Thread failure
- o Improperly lockwired
- o Defective or damaged sealing surface
- o Contamination

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 Pump Assembly is designed and qualified in accordance with end item specification 10SPC-0050. (All failure causes)
- o Rosan boss fittings incorporate self locking provisions (lockwire not required) and are used on the quick disconnect and dynatube connectors. (Improper torque, improperly lockwired)
- o All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540. (Improper torque, improperly lockwired)

- o Hydrazine is filtered through a 25 Micron filter upstream of the fuel pump. (Contamination)
- o APU surfaces exposed to Hydrazine, except gas generator, are cleaned per 10PRC-0339. (Contamination)
- o Fluid procurement is controlled per SE-S-0073. (Contamination)
- o O-ring material is Ethylene Propylene selected for compatibility with hydrazine. (Defective or damaged o-ring)
- 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 S00FMO.430. (All failure causes)
- o Qualification testing verified design requirements as reported in Sundstrand Qualification Test Report AER-1539-6. (All failure causes)

#### B. TESTING

- o Acceptance testing is performed per Sundstrand TS-2535 and TS-2409 on new units. This includes a leak check of the entire fuel pump assembly at  $100 \pm 25$ psig Helium, fuel pump shaft seal check at  $350 \pm 50$  psig, GN2 spin and decontamination and precision cleaning of the fuel system. (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 flight hardware 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 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 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 During refurbishment and prior to reuse the fuel pump assembly is subjected to the same acceptance testing as new units per Sundstrand TS-2535 and TS-2409. (Defective or damaged O-ring, defective or damaged sealing surface, contamination, thread failure)

- o Hotfire test is performed during hotfire operations to demonstrate proper function per 10REQ-0021, para. 2.3.16 prior to hotfire. (Defective or damaged O-ring, defective or damaged sealing surface, contamination, thread failure)
  
- o APU fuel system blanket pressure decay test is performed per OMRSD File V, Vol. I, Requirement Number B42AP0.030. This test verifies the integrity of APU-fuel pump shaft seal. (All Failure Causes)
  
- o Fuel system pressure is measured during launch countdown per LCC.(Defective or damaged O-ring, defective or damaged sealing surface, thread failure)

C. INSPECTION

VENDOR RELATED INSPECTION

- o Verification of O-rings inspection by USA SRBE PQAR per SIP 1128. (Defective or damaged O-ring)
  
- o Acceptance testing is witnessed per SIP 1128 by USA SRBE PQAR. (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 per SIP 1128 by USA SRBE PQAR. (All failure causes)
  
- o Vendor inspection and test records are verified per SIP 1128 by USA SRBE PQAR. (All failure causes)
  
- o Material certifications are verified per SIP 1128 by USA SRBE PQAR. (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 Torque operations are verified per SIP 1128 by USA SRBE PQAR. (Improper torque)
  
- o Critical Processes/Inspections:
  - Annealing, filter cover per QQ-S-763.

## KSC RELATED INSPECTIONS

- o Helium (influent) cleanliness and composition (purity and particulate count) are verified prior to fuel pump shaft seal leak check per 10REQ-0021, para. 2.3.2.5. (Contamination)
- 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 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. (Defective or damaged O-ring)
- o Sealing surfaces are inspected prior to installation/connection, verifying no contaminant or obstruction exists per 10REQ-0021, para. 2.3.0.(Defective or Damage Sealing Surface)
- 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 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. (Defective or damaged O-ring, defective or damaged sealing surface, thread failure)
- 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 OMRSD File V, Vol. 1, requirement number B42APO.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) 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)

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- o Hydrazine (from servicing cart) 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 B42AP0.010. (Contamination)
- o Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. I, requirement number B42AP0.030 (All Failure Causes)
- o Proper function of TVC system is demonstrated during hotfire operations per 10REQ-0021 to include hotfire, para. 2.3.16.2. (Defective or damaged O-ring, defective or damaged sealing surface, thread failures)
- o Post hotfire verification, including inspections and leak checks per 10REQ-0021, para. 2.3.16.4. (Defective or Damaged O-ring, Defective or Damaged Sealing Surface, 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.