

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fuel Pump Assembly

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

FM CODE: A07

ITEM CODE: 20-01-11

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000

CRITICAL PHASES: Final Countdown

SUPERCEDES: March 31, 1997

FMEA PAGE NUMBER: A-28

ANALYST: R. Imre/ S. Parvathaneni

SHEET 1 OF 9

APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: External leakage of hydrazine through overboard drain line (System A and/or B) at shaft seal or any one of two O-rings caused by:

- o Defective or damaged shaft seal
- o Defective or damaged O-ring
- o Defective or damaged sealing surface
- o Contamination

FAILURE EFFECT SUMMARY: Fire and explosion will lead to loss of mission, vehicle and crew.

Note: A cracked shaft carbon seal may allow metal to metal contact causing auto decomposition of hydrazine leading to rupture of the fuel pump. (See CIL 20-01-11-A06)

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 Shaft seal material is pure carbon 658 RC. (Defective or Damaged Shaft Seal)
- o O-ring material is ethylene propylene selected for compatibility with hydrazine. (Defective or Damaged O-Ring)
- o Shaft is 15-5 PH steel heat treated to H1025. (Defective or Damaged Sealing Surface)

- 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 is purged with GN2 prior to APU start. This reduces the O₂ concentration to less than 4% per OMRSD File II, Vol. 1, requirement No. S00FM0.430. (All Failure Causes)
- o Qualification testing verified design requirements are reported in Sundstrand Qualification Test Report AER-1539-6. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per Sundstrand ATP TS- 2409 on new units. This includes a leak check of the entire fuel pump assembly at 100 ± 25 psig helium fuel pump shaft seal leak check at 350 ± 50 psig, hotfire 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 testing as new units, after precision cleaning per Sundstrand ATP TS-2409. (All Failure Causes)
- 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 Fuel pump shaft seal static leakage rate is determined prior to APU installation per 10REQ-0021, para. 2.1.3. (Defective or Damaged Shaft Seal, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface)
- o Fuel pump shaft seal static leakage rate is determined after hydraulic pump mating per 10REQ-0021, para. 2.1.3. (Defective or Damaged Shaft Seal, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface)
- 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 B42APO.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 B42APO.012. (Contamination)

- o Hotfire testing is performed during hotfire operations to demonstrate proper function per 10REQ-0021, para. 2.3.16. (Defective or Damaged Shaft Seal, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface)
- o Fuel pump shaft seal is checked for leakage per 10REQ-0021 as follows: (Defective Shaft Seal)
 - After low speed GN2 spin, para. 2.3.11.3
 - After high speed GN2 spin, para. 2.3.15.5
 - After Hotfire, para. 2.3.16.4.
- 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 APU fuel system blanket pressure decay test is performed per OMRSD file V, Vol. I, requirement number B42AP0.030. (All Failure Causes)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTION

- o Vendor inspection and test records are verified per SIP 1128 by USA SRBE PQAR. (All Failure Causes)
- o Verification of O-ring inspection by USA SRBE PQAR per SIP 1128. (Defective or Damaged O-Ring)
- o Material certifications are verified per SIP 1128 by USA SRBE PQAR. (Defective or Damaged Shaft Seal, Defective or Damaged O-Ring)
- o Seals and sealing surfaces are verified per SIP 1128 by USA SRBE PQAR. (Defective or Damaged Shaft Seal, Defective or Damaged O-Ring, Defective or Damaged Sealing Surface).
- o Acceptance testing is witnessed per SIP 1128 by USA SRBE PQAR. (All Failure Causes)
- o Verifications that are required on new units are performed on refurbished units per SIP 1128 by USA SRBE PQAR. (All Failure Causes)

o Critical Processes/Inspections:

None

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 Fuel pump shaft seal static leakage is verified prior to APU installation to a maximum of 20 cc/min per 10REQ-0021, para. 2.1.3. (Defective Shaft Seal)
- o Verification of fuel pump shaft seal leakage maximum of 20 cc/min after hydraulic pump mating per 10REQ-0021, para. 2.1.3. (Defective Shaft Seal)
- o Verification of fuel pump shaft seal leakage rate within acceptable limits of 0.46 cc per minute maximum per 10REQ-0021 para 2.3.16.4b. (Defective or Damaged Sealing Surface, Defective or Damaged O-Rings, 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 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 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 Proper function of TVC system is demonstrated during hotfire operations per 10REQ-0021 to include hotfire, para. 2.3.16. (Defective or damaged O-ring, Defective or damaged sealing surface)
- o Fuel pump shaft seal is checked for leakage per 10REQ-0021 as follows: (Defective Shaft Seal)
 - After low speed GN2 spin, para. 2.3.11.3
 - After high speed GN2 spin, para. 2.3.15.5
 - After hotfire, para. 2.3.16.4.

- 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 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) purity and particulate count are verified prior to introduction on-board hydrazine circuits per OMRSD File V, Vol. 1, requirement number B42AP0.012. (Contamination) CN 038
- 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 APU Fuel system GN2 blanket pressure check per File V, Vol. I, requirement number B42APO.030 (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.