

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fuel Pump Assembly (Part of APU)

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

FM CODE: A06

ITEM CODE: 20-01-11

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 1997

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 1, 1995

FMEA PAGE NUMBER: A-27

ANALYST: R. Imre/ H. Longani

SHEET 1 OF 5

APPROVED: P. Kalia

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DCN032

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

- o Material defect
- o Manufacturing defect

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

Note: In addition, material and/or Manufacturing Defects of the shaft seal can lead to the fracture of the carbon seal, allowing metal to metal contact leading to auto decomposition of the hydrazine resulting in fire and explosion.

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 Material selection is per MSFC-SPEC-522A. (Material Defect)
- o The filter bowl drain quick disconnect is a 300 series stainless steel. (Material Defect)
- o Shaft seal material is pure carbon 658RC. (All Failure Causes)
- o Fuel pump housing is designed for a maximum operating pressure of 1515 ± 25 psig and is proof pressure tested to 2287 ± 37 psig (I.S.S.F). (Material Defect)

- o Fuel pump housing and pump cover material is aluminum alloy per MIL-A- 21180 C355 Class 12 and is one hundred percent penetrant inspected. (Material Defect)
- o Filter cover material is CRES 304L Cond. A per QQ-S-763. (Material Defect)
- o Fluid procurement is controlled by SE-S-0073. (Material Defect)
- o The fuel pump is pressure relieved at 1750 ± 50 psig. (All Failure Causes)
- o The filter bowl drain quick disconnect is designed for a burst pressure of 3750 psig (S.F. 2.0) (Material Defect)
- o The aft skirt area is purged with GN2 prior to APU start. This reduces the 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 The filter bowl drain QD is proof tested to 2250 psig for a safety factor of 1.5. (All Failure Causes)
- o Fuel pump housing is proof pressure tested to 2287 ± 37 psig per Sundstrand drawing 723322 for the new fuel pump. For the refurbished fuel pump, the proof pressure testing of housing is done at intervals not to exceed every 4 mission cycles and for housing cover every 11 mission cycles. (Material Defect)
- o Acceptance testing is performed per Sundstrand ATP TS 2409 on new units. This includes a leak check of entire fuel pump assembly at 100 ± 25 psig helium, fuel pump shaft seal leak check 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 returned to the vendor for rework and ATP testing per Sundstrand ATP TS-2409. (All Failure Causes)
- 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. (Material Defect)
- o Fuel system leak check at $380 -0/-10$ psig is performed per 10REQ-0021, para. 2.3.3.1. (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. (Material Defect)
- 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. (Material Defect)
- o GN2 is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board flight hardware per 10REQ-0021, para. 2.3.2.2 and OMRSD File V, Vol. 1, requirement number B42AP0.012. (Material Defect)
- o Hotfire test of APU is performed during hotfire operations to demonstrate proper function per 10REQ-0021, para. 2.3.16. (All Failure Causes)
- 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. (Material Defect)
- o Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. I, requirement number B42AP0.030 (All Failure Causes)

DCN032

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 USBI QAR. (All Failure Causes)
- o Verification of proper manufacturing and assembly per SIP 1128 by USBI QAR. (Manufacturing defects)
- o Verification of material certifications per SIP 1128 by USBI QAR. (Material Defect)
- o Verification of fuel pump housing proof pressure test per SIP 1128 by USBI QAR. (All Failure Causes)
- o Witnessing of acceptance testing per SIP 1128 by USBI QAR. (All Failure Causes)
- o Verifications that are required on new units are performed on refurbished units per SIP 1128 by USBI QAR. (All Failure Causes)

o Critical Processes/Inspections:

- Penetrant per CP16.03-01
- Heat treat per MIL-H-6088
- X-ray per CP16.01-01

KSC RELATED INSPECTIONS

- 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. (Material Defect)
- o Helium (influent) cleanliness and composition (purity and particulate count) are verified prior to fuel pump seal leak check per 10REQ-0021, para. 2.3.2.5. (Material Defect)
- o Precision cleaning of tubes/hoses is verified by USBI per 10REQ-0021- 2.3.0. (Material Defect)
- 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. (Material Defect)
- o GN2 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. (Material Defect)

- o Proper function of TVC system is demonstrated during hotfire operations per 10REQ-0021 to include hotfire, para. 2.3.16. (All Failure Causes)
- 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. (All Failure Causes)
- o Post hotfire verification including inspection and leak check per 10REQ- 0021, para. 2.3.16.4. (All Failure Causes)

- o GN2 (from MLP portable panels) 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. (Material Defect)
- 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. (Material Defect)

- 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. (Material Defect)
- o Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. 1, requirement number B42APO.030 (All Failure Causes)

DCN032

D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.