

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Gas Generator Valve Module

PART NO.: 5902651
5912183 (alternate)

FM CODE: A05

ITEM CODE: 20-01-14

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NUMBER REQUIRED: 2

DATE: March 31, 2000

CRITICAL PHASES: Final Countdown,
Boost

SUPERCEDES: March 31, 1999

FMEA PAGE NUMBER: A-47

ANALYST: C.J. Smith/ S. Parvathaneni

SHEET 1 OF 5

APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: External leakage of hydrazine (System A and/or B) past the injector stem primary and secondary O-rings or any one of two retainer/nut primary and secondary O-rings caused by:

- o Defective or damaged O-ring
- o Defective or damaged sealing surface
- o Contamination
- and -
- o Defective or damaged O-ring
- o Defective or damaged sealing surface
- o Contamination
- o Improper torque
- o Improperly lockwired

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

REDUNDACY SCREENS AND MEASUREMENTS:

- 1) Fail - Loss of redundancy not detectable during turnaround or refurbishment.
- 2) Fail - Loss of redundancy not detectable
- 3) Fail - Contamination

RATIONALE FOR RETENTION:

A. DESIGN

- o The Gas Generator Valve Module is designed and qualified in accordance with end item specification 10SPC-0050. (All Failure Causes)
- o O-ring material is ethylene propylene selected for its compatibility with liquid hydrazine. (Defective or Damaged O-Ring)
- o Hydrazine is filtered through two 25 micron filters upstream of the GGVM. (Contamination)
- o All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540. (Improper Torque, Improperly Lockwired)
- 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 The Aft skirt area is purged with GN2 prior to APU startup. 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, and AER-1539-10, Rev. Basic. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per Marotta ATP 281951-9002 on each new unit. This includes visual and dimensional examination, proof pressure, external leakage, internal leakage and cleanliness level check (All Failure Causes) (Retainer Nut Only)
- o Abbreviated acceptance testing of units that only require rework of the solder joints is performed per Marotta AATP281951-9002. This includes visual and dimensional examination, internal leakage and cleanliness level check. (All Failure Causes)
- o Sundstrand In Process Confidence Test requires helium leak check of injection stem primary/secondary O-rings and sealing surface per Sundstrand drawing 737722/1700061(Alt.). (Defective or Damaged O-ring, Defective or Damaged Sealing Surface, Contamination)
- o Acceptance testing of the assembled APU is performed per Sundstrand ATP TS 2409. This includes hotfire acceptance test and decontamination and precision cleaning of the fuel system. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Contamination)
- o During refurbishment and prior to reuse, the GGVM is tested per Sundstrand ATP TS 2409, just as new units. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface, Contamination) (Retainer Nut Only)

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- o Helium (influent) is verified for cleanliness and composition (purity and particulate count) prior to fuel shaft seal leak check per 10REQ-0021, para. 2.3.2.5. (Contamination) (Retainer Nut Only)
- 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 TVC system functional test is performed during hotfire per 10REQ-0021, para. 2.3.16. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface)
- 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 Verification of FSM bottle pressure for hydrazine system pressure check per File V, Vol. I, requirement number B42AP0.025. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface) (Retainer Nut Only)

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 test data from Marotta is performed per SIP 1128 by USA SRBE PQAR. (All Failure Causes)
- o Verification of GGVM assembly is performed in a 100K clean room per SIP 1128 by USA SRBE PQAR. (Contamination)
- o Verification of material certifications are verified per SIP 1128 by USA SRBE PQAR. (Defective or Damaged O-Ring)

- o Verification of vendor inspection of seals and sealing surfaces is performed per SIP 1128 by USA SRBE PQAR. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface)
- o Verification of torque operations is performed per SIP 1128 by USA SRBE PQAR. (Improper Torque)
- o Verification of lockwiring of fittings is performed per SIP 1128 by USA SRBE PQAR. (Improper Lockwire)
- o Verification of final tests is performed per SIP 1128 by USA SRBE PQAR. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surfaces)
- o Witnessing of acceptance testing is performed per SIP 1128 by USA SRBE PQAR. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surfaces, Contamination)
- 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 INSPECTION

- o Helium (influent) cleanliness and composition (purity and particulate count) are verified prior to fuel shaft seal leak check per 10REQ-0021, para. 2.3.2.5. (Contamination) (Retainer Nut Only)
- 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) (Retainer Nut Only)
- 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. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface)
- o Inspections for leaks, rubbing and discoloration are conducted per 10REQ-0021, paras. 2.3.11.3 and 2.3.15.5 respectively following low speed GN2 spin and high speed GN2 spin. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface) (Retainer Nut Only)
- o Post hotfire inspection and leak check per 10REQ-0021, para 2.3.16.4. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface) (Retainer Nut Only)
- o GN2 (from MLP portable panels) cleanliness and composition 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)
- 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 FSM bottle pressure for hydrazine system pressure check per File V, Vol. I, requirement number B42AP0.025. (Defective or Damaged O-Ring, Defective or Damaged Sealing Surface) (Retainer Nut Only)

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D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.