

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Gas Generator Valve Module

PART NO.: 5902651
5912183 (alternate)

FM CODE: A11

ITEM CODE: 20-01-14

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000

CRITICAL PHASES: Final Countdown

SUPERCEDES: March 31, 1999

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SHEET 1 OF 5

APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: While opening, the shutoff (Secondary) Control Valve (NC) sticks between closed and open (System A and/or B) caused by:

- o Contamination
- o Spring failure
- o Poppet/sleeve galling

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 Gas Generator Valve Module is designed and qualified in accordance with end item specification 10SPC-0050. (All failure causes)
- o The shutoff valve is normally closed. (Spring Failure and Poppet/Sleeve Galling)
- o The shutoff valve is a 28 VDC direct acting poppet type solenoid. (Poppet/Sleeve Galling)
- o The poppet seat is Tefzel HT-2004 which is a high tensile strength teflon material. (Poppet/Sleeve Galling)
- o Spring material is 17-7PH Cres CH900. Spring is in a protected environment. (Spring Failure)
- o Sleeve (Body/Retainer) material is 6AL-4V Titanium 303 stainless steel with an EPR O-ring which seals and maintains a stand-off. (Poppet/Sleeve Galling)

- o Hydrazine is filtered through two 25 micron filters upstream of the GGVM. (Contamination)
- o The APU controller has BITE capability to verify operation of the valves. (Spring Failure, Poppet/Sleeve Galling)
- 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)
- o Spring is contained with only 0.010 to 0.011 inch of poppet travel to absorb. (Spring Failure)
- o APU surfaces exposed to hydrazine, except gas generator, are cleaned to level 100 of MA0110-301. (Contamination)
- o Fluid procurement is controlled per SE-S-0073. (Contamination)

B. TESTING

- o Acceptance testing is performed per Marotta ATP 281951-9002 on each new unit. This includes visual and dimensional examination, pull-in voltages, stem travel, Response, Flow Test and Valve Cycle Test and cleanliness leak check. (All Failure Causes)
- o Abbreviated acceptance testing of units that only require rework of the solder joints is performed per Marotta ATP 281951-9002. This includes visual and dimensional examination, internal leakage and cleanliness level check. (All Failure Causes).
- o Acceptance testing of the assembled APU is performed per Sundstrand ATP TS2409. This includes verification of proper valve operation at all rated turbine speeds and decontamination and precision cleaning of the fuel system. (All Failure Causes)
- o During refurbishment and prior to reuse, the GGVM is tested per Sundstrand ATP TS2409. (All Failure Causes)
- 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 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. (Contamination)
- o TVC system functional test is performed during hotfire per 10REQ-0021, para. 2.3.16. (Spring Failure, Poppet/Sleeve Galling)
- o HPU BITE test verifying control valve operation is performed per 10REQ-0021, para. 2.3.4. (Spring Failure, Poppet/Sleeve Galling)

- o BITE test verifying control valve operation is performed per OMRSD File V, Vol. 1, requirement number B42AP0.060 prior to rollout. (Spring Failure, Poppet/Sleeve Galling)
- o BITE test verifying control valve operation is performed during launch countdown (approximately T-11 hour) per OMRSD File V, Vol. 1, requirement number B42AP0.060. This is the last check of valve operation prior to APU startup. (Spring Failure, Poppet/Sleeve Galling)
- 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 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 BITE test is conducted per OMRSD File V, Vol. 1, requirement number B42AP0.060. (Spring Failure, Poppet/Sleeve Galling)
- o Verification of operation of the valve during APU startup in launch countdown per OMRSD File II, Vol. I, requirement number S00FR0.070. (Spring failure, Poppet/Sleeve Galling)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Verification of test data from Marotta per SIP 1128 by USA SRBE PQAR. (All Failure Causes)
- o Verification of material certifications per SIP 1128 by USA SRBE PQAR. (Spring Failure, Poppet/Sleeve Galling)
- o Verification of GGVM assembly in a 100K clean room per SIP 1128 by USA SRBE PQAR. (Contamination)
- o Verification of final leak tests per SIP 1128 by USA SRBE PQAR. (Spring Failure, Poppet/Sleeve Galling)
- o Witnessing of acceptance testing 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 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
 - Heat Treating per MIL-H-6875

KSC RELATED INSPECTIONS

- o Precision cleaning of APU attach tubes hoses is verified by USA SRBE per 10REQ-0021, para. 2.3.0. (Contamination)
- o Proper function of TVC system is demonstrated during hotfire operations per 10REQ-0021 to include hotfire, para. 2.3.16. (Spring Failure, Poppet/Sleeve Galling)
- 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 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 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 B42AP.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 OMRSD File V, Vol. 1, requirement number B42AP.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).

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- o GN2 (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 B42AP0.012 (Contamination)
- 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 proper valve operation during BITE test per OMRSD File V, Vol. 1, requirement number B42AP0.060. (Spring Failure, Poppet/Sleeve Galling)
- o Verification of APU Fuel system GN2 blanket pressure check per File V, Vol. I, requirement number B42APO.030 (Spring Failure, Poppet/Sleeve Galling)
- o Verification of APU BITE test per OMRSD File V, Vol. 1, requirement number B42AP0.060. (Frequency) (Spring Failure, Poppet/Sleeve Galling)
- o Verification of proper performance of BITE test per OMRSD File V, Vol. 1, requirement number B42AP0.060 during launch countdown. (Spring Failure, Poppet/Sleeve Galling)

D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.