

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Gas Generator Valve Module

PART NO.: 5902651
5912183 (alternate)

FM CODE: A03

ITEM CODE: 20-01-14

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000

CRITICAL PHASES: Boost

SUPERCEDES: March 31, 1999

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ANALYST: R. Imre/S. Parvathaneni

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APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: Pulse (Primary) control valve (NO) fails to open. (Throttles low - System A and B) caused by:

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

FAILURE EFFECT SUMMARY: Loss of TVC will lead to loss of mission, vehicle and crew. One success path remains after the first failure. Operation is not affected until both paths are lost.

REDUNDANCY SCREENS AND MEASUREMENTS:

- 1) Pass - All units are subject to ATP during turnaround and refurbishment.
- 2) Pass - APU turbine speed measurements - B46R1406C, B46R1407C, B46R1408C, and B46R1409C.
- 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 The pulse (primary) control valve is normally open. (Spring Failure, Poppet/Sleeve Galling)

- o The pulse valve spring is heat treated 17-7PH Cres contained in a protected environment. (Spring Failure)
- o Poppet (stem) material is 303 stainless steel with an EPR O-ring which seals and maintains a standoff. (Poppet/Sleeve Galling)
- o Sleeve (body/retainer) material is 6AL-4V Titanium. (Poppet/Sleeve Galling)
- o Hydrazine is filtered through two 25 micron filters upstream of the GGVM. (Contamination)
- o Valves are direct acting poppet type solenoid valves. (Poppet/Sleeve Galling)
- 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 APU controller has BITE capability to verify function of valves. (Spring Failure, Poppet/Sleeve Galling)
- 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 pull-in voltage, stem travel, response, flow test, valve cycle test and cleanliness level check. (All Failure Causes)
- 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 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 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 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 HPU BITE test is performed per 10REQ-0021, para. 2.3.4. (Spring Failure, Poppet/Sleeve Galling)
- o TVC system functional test is performed during hotfire per 10REQ-0021, para. 2.3.16. (Spring Failure, Poppet/Sleeve Galling)
- 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 BITE test verifying APU speed control valve operation is performed per OMRSD File V, Vol. 1 Requirement Number B42AP0.060. (Spring Failure, Poppet/Sleeve Galling)
- o APU BITE test is conducted per OMRSD File V, Vol. 1 Requirement Number B42AP0.060. (Spring Failure, Poppet/Sleeve Galling)
- o BITE test verifying APU speed 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)

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Vendor inspection and test records are verified per SIP 1128 by USA SRBE PQAR. (All Failure Modes)
- o Verification of test data from Marotta per SIP 1128 by USA SRBE PQAR. (All Failure Causes)
- o Verification of GGVM assembly in a 100K clean room per SIP 1128 by USA SRBE PQAR. (Contamination)
- o Verification of material certifications per SIP 1128 by USA SRBE PQAR. (Spring Failure and Poppet/Sleeve Galling)
- o Witnessing of acceptance testing is performed 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/Inspection:

- Heat treating per MIL-H-6875

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 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)
- 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. (Spring Failure, Poppet/Sleeve Galling)
- o GN2 (from MLP portable panels) 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 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 Verification of proper valve operation during BITE test per OMRSD File V, Vol. 1 Requirement Number B42AP0.060. (Spring Failure, Poppet/Sleeve Galling, 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 B42APO.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)

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- o Verification of proper performance of BITE test per OMRSD File V, Vol. 1 Requirement Number B42AP0.060 during launch countdown. (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.