

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Start Bypass Valve

PART NO.: Part of 740412/734579(ALT.)
includes:
5001054 (Sleeve)
5001055 (Piston)
5001056 (Spring)

FM CODE: A03

ITEM CODE: 20-01-12

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000

CRITICAL PHASES: Boost

SUPERCEDES: March 31, 1997

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ANALYST: B. Snook/S. Parvathaneni

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APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: Fails to close or remain closed (System A and B) caused by:

- o Piston/sleeve galling
- o Contamination
- o Defective or damaged seat
- o Defective or damaged sealing surface
- o Defective or damaged O-ring
- o Spring failure

FAILURE EFFECT SUMMARY: Loss of TVC will lead to vehicle breakup and 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 - Function is verified during refurbishment and prelaunch testing.
- 2) Pass - APU turbine speed measurements B46R1406C, B46R1407C, B46R1408C, B46R1409C.
- 3) Fail - Contamination.

RATIONALE FOR RETENTION:

A. DESIGN

- o The Start Bypass Valve is designed and qualified in accordance with end item specification 10SPC-0050.
- o Piston is a heat treated 13-2 corrosion and heat resistant steel with a Rockwell hardness of C42-46 (195-200 KSI tensile). (Piston/Sleeve Galling)
- o Sleeve is a heat treated 13-2 corrosion and heat resistant steel with a Rockwell hardness of C42-46. (Piston/Sleeve Galling)
- o Seat is a metal to metal seal per AMS5616 Greek Ascoloy. (Defective or Damaged Seat)
- o Piston and sleeve are toleranced to .0035" max and .0015" min. (Piston/ Sleeve Galling)
- 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 O-ring material is ethylene propylene selected for compatibility with hydrazine. (Defective or Damaged O-Ring)
- o Fluid procurement is controlled per SE-S-0073. (Contamination)
- o Qualification testing verified design requirements as reported in Sundstrand APU Qualification Test Report AER-1539-6 Rev. B. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per Sundstrand ATP TS 2409 Rev. Y on new APUs. This includes verification of the proper operation of the start bypass valve and decontamination and precision cleaning of the fuel system. (All Failure Causes)
- o During refurbishment and prior to reuse, the valve is subjected to the same ATP standards as new units 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 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 Proper TVC system function is demonstrated during hotfire operations per 10REQ-0021, para. 2.3.16. (Piston/Sleeve Galling, Defective or Damaged O-Ring)
- 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)

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 material certifications per SIP 1128 by USA SRBE PQAR. (Defective or Damaged Seat, Defective or Damaged O-Ring)
- o Seals and sealing surfaces are verified per SIP 1128 by USA SRBE PQAR. (Defective or Damaged Seat, Defective or Damaged Sealing Surface, Defective or Damaged O-Ring)
- 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:
 - Heat Treat per MIL-H-6875
 - Magnetic Particle Inspection per CP 16.04-01

KSC RELATED INSPECTIONS

- o Helium (Influent) cleanliness and composition (purity and particulate count) are verified prior to fuel pump shaft seal leak check by USA SRBE per AM B8510. (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. (Piston/Sleeve Galling, Defective or Damaged Seat, Defective or Damaged Sealing Surface, Defective or Damaged O-Ring)
- 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 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)

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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.