SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Relief Valve

PART NO.: 57926 (Part of 740412/ 734579(ALT.))

FM CODE: A02

ITEM CODE: 20-01-12A

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 31, 2000

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CRITICAL PHASES: Boost

SUPERCEDES: March 31, 1997

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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 Spring Failure
- o Contamination
- o Defective or damaged O-ring
- o Defective or damaged sealing surface
- o Spring guide/Poppet stem galling
- o Poppet loosening

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 - Valve operation verified 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 Relief Valve is designed and qualified in accordance with end item specification 10SPC-0050. (All failure causes)

- o Cracking pressure is 1750 $\pm$ 50 psig.Reseat pressure is 1525 psig min. during normal fuel pump operation. Normal fuel pump operating pressure is 1500 psig. (All Failure Causes)

- o Hydrazine is filtered through a 25 micron filter upstream of the fuel pump. (Contamination)
- o Spring material is passivated 17-7PH CRES, CH900. (Spring Failure)
- o Poppet stem material is 304 CRES with redundant EPR O-rings which seal and maintain a standoff. (Spring Guide/Poppet Stem Galling)
- o Spring guide material is 316 CRES. (Spring Guide/Poppet Stem Galling)
- o Seat material is aluminum alloy 2024-T851. (Defective or Damaged Sealing Surface)
- o O-Rings are ethylene propylene selected for compatibility with hydrazine. (Defective or Damaged O-Ring)
- o APU surfaces exposed to hydrazine, except gas generator are cleaned per 10PRC-0339. (Contamination)
- o Poppet is torqued per engineering specificaitons and has a set screw for a locking device. (Poppet Loosening)
- o Fluid procurement is controlled per SE-S-0073. (Contamination)
- o Qualification testing verified design requirements as reported in Sundstrand Qualification Test Report EAR-1539-6, Rev. B. (All Failure Causes)

B. TESTING

- o Proper relief valve operation is tested per Sundstrand fuel pump ATP TS 2535. This includes post relief valve actuating flow check. (All Failure Causes)
- o Acceptance testing is performed per Sundstrand ATP TS 2409 on the new units. This includes decontamination and precision cleaning of fuel system. (All Failure Causes)
- o During refurbishment and prior to reuse, the relief valve is subjected to acceptance testing just as new units per Sundstrand ATP TS 2535. (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)

- Hydrazine is verified for cleanliness and composition (purity and particulate count) prior to loading per 10REQ-0021, para. 2.3.2.1 and OMRSD File V, Vol. 1 Requirement Number B42AP0.010. (Contamination)

- 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)

- Proper functional test of APU is performed during hotfire per 10REQ-0021, para. 2.3.16. (All Failure Causes)

- 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)

- SRB HPU performance is monitored by automated software in GLS per OMRSD File II, Vol. 1, Requirement Number S00FR0.070. (All Failure Causes)

C. INSPECTION

VENDOR RELATED INSPECTIONS

- Vendor inspection and test records are verified per SIP 1128 by USA SRBE PQAR. (All Failure Causes)

- Vendor (Circle Seal) test data is verified per SIP 1128 by vendor and USA SRBE. (All Failure Causes)

- Sundstrand receiving inspection records are verified per SIP 1128 by USA SRBE PQAR. (All Failure Causes)

- All material certifications are verified per SIP 1128 by USA SRBE PQAR. (Spring Failure, Spring Guide/Poppet Step Galling)

- Verification of sealing surface inspection is performed per SIP 1128 by vendor and USA SRBE PQAR. (Defective or Damaged Sealing Surfaces)

- Acceptance tests are witnessed per SIP 1128 by vendor and USA SRBE PQAR. (All Failure Causes)

- Verifications that are required on new units are performed on refurbished units per SIP 1128 by USA SRBE PQAR. (All Failure Causes)

- Critical Processes/Inspections:

  - Heat Treat per MIL-H-6875

  - Passivation (Circle Seal Controls) per MPB 56:00

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KSC RELATED INSPECTIONS

- 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)

- Precision cleaning of tubes/hoses is verified by USA SRBE per 10REQ-0021, para. 2.3.0. (Contamination)

- 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)

- 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)

- 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)

- Proper function of TVC system is demonstrated during Hotfire operations per 10REQ-0021, para. 2.3.16 to include Hotfire. (All Failure Causes)

- 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)

- 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)

- 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)

- 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 SRB HPU performance is monitored by automated software in GLS per OMRSD File II, Vol. 1, Requirement Number S00FR0.070. (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.