SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Seals and Sampling Valves
Part of Servoactuator

PART NO.: 10200-0098-801 (Valve, Bleeder) (A79386)
A23973-3 (Body), (A71183-1 Body),
A23913 (Actuator Assembly)
A23953-4 (Packing, Preformed)

FM CODE: A01

ITEM CODE: 20-02-13

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 4 (two per actuator)

DATE: March 1, 2002

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 1, 2001

FMEA PAGE NO.: A-225

ANALYST: B. Snook/S. Finnegan

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SHEET 1 OF 4

APPROVED: S. Parvathaneni

FAILURE MODE AND CAUSES: External leakage of hydraulic fluid, (System A and/or B) at bleed valve body seal O-ring, caused by:

- Defective or damaged sealing surface
- Improper torquing
- Improper lockwire
- Contamination
- Thread failure
- Defective or damaged O-ring

FAILURE EFFECT SUMMARY: Loss of hydraulic fluid leading to loss of both actuators. Fire and explosion will lead to loss of mission, vehicle, and crew.

REDUNDANCY SCREENS AND MEASUREMENTS: N/A

RATIONALE FOR RETENTION:

A. DESIGN

- The Seals and Sampling Valves are designed and qualified in accordance with end item specification 10SPC-0174. (All failure causes)

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- Material selection is in compliance with MSFC-SPEC-522A. (Defective or Damaged Sealing Surface, Thread Failure)

- o O-ring material is Viton which is compatible with hydraulic fluid. (Defective or Damaged O-ring)

- o All threaded fittings are torqued per engineering specification and lockwired per MS 33540 as applicable. (Improper Torque, Improper Lockwire)

- o Fluid procurement is per SE-S-0073. (Contamination)

- o Hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to minimize the fire potential. (Contamination)

- o The bleed valve is designed to withstand 6500 psig proof pressure and continue to function properly. (Thread Failure, Defective or Damaged Sealing Surface)

- o The Aft Skirt Area is purged with GN2 prior to APU startup. This reduces the 02 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 circle seal test report QTR 815. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per circle seal ATP TM 1068. This includes visual examination, fluid cleanliness, leak test for no evidence of leakage and proof pressure to 6500 psig. (All Failure Causes)

- o Helium is sampled 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 Visual leak check of hydraulic circuit (system) joints is performed per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)

- o Hydraulic fluid is sampled for cleanliness and composition (purity and particulate count) prior to introduction to on-board Hydraulic circuits per 10REQ-0021, para. 2.3.2.6. (Contamination)

- o Functional test is performed during hotfire operations per 10REQ-0021, paras. 2.3.11, 2.3.15, and 2.3.16 respectively for: (All Failure Causes)
  - Low speed GN2 spin
  - High speed GN2 spin
  - Hotfire

- o Helium leak test to less than 1×10^{-4} sccs is performed per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)

- o Hydraulic fluid is sampled for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydraulic circuits during prelaunch operations per OMRSD File V, Vol. 1, requirement number B42HP0.010. (Contamination)

- o Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, requirement number B42HP0.020. (All Failure Causes)

- o The above referenced OMRSD testing is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Manufacturing is controlled by USA SRBE per SIP 1390. (All failure causes)

- o Vendor acceptance of dimensional conformance is verified by USA SRBE PQAR per SIP 1390. (Defective or Damaged Seal, Defective or Damaged O-ring, and Defective or Damaged Sealing Surface)

- o Verification of O-rings cure date by USA SRBE PQAR per SIP 1390. (Defective or Damaged O-ring)

- o All material certifications are verified by USA SRBE PQAR per SIP 1390. (Defective or Damaged Sealing Surface)

- o Cleanliness of components is verified by USA SRBE PQAR per SIP 1390. (Contamination)

- o Verification of threads per SIP 1390. (Thread failures)

- o Final acceptance tests are witnessed by USA SRBE PQAR per SIP 1390. (All Failure Causes)

- o Final inspection and packaging is verified by USA SRBE PQAR per SIP 1390. (All Failure Causes)

- o Verification of proper torque and lockwire of valve body into the actuator per Moog drawing A23913. (Improper Torque, Improper Lockwire)

- o Critical Processes/Inspections:

  - None

KSC RELATED INSPECTIONS

- o Helium cleanliness is verified per 10REQ-0021, para. 2.3.2.5. (Contamination)

- o Hydraulic system helium leak test is witnessed per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)

- o Hydraulic fluid purity and particulate count are verified prior to introduction to on-board hydraulic circuits per 10REQ-0021, para. 2.3.2.6. (Contamination)

- o Witness the torque/lockwire applied to critical components per 10REQ-0021 para 2.1.4 (Improper torque, Improper lockwire)

- o Verify Rock Hydraulic Reservoir level is greater than 30 percent per 10REQ-0021, para. 2.3.11.2 during low speed GN2 spin. (All Failure Causes)

- o Verify Tilt Hydraulic Reservoir level is greater than 30 percent per 10REQ-0021, para. 2.3.11.2 during low speed GN2 spin. (All Failure Causes)

- o Verify Rock Hydraulic Reservoir level is greater than 50 percent during high speed GN2 spin per 10REQ-0021, para. 2.3.15.2. (All Failure Causes)

- o Verify Tilt Hydraulic Reservoir level is greater than 50 percent during high speed GN2 spin per 10REQ-0021, para. 2.3.15.2. (All Failure Causes)

- o Verification of L. P. and H. P. hydraulic Bleed Valve seating and cap are torqued and lockwired per 10REQ-0021, para. 2.1.4. (Improper torque, Improper lockwire)

- o Verification of L.P. and H.P. hydraulic Bleed Valve seating and cap for torquing and lockwiring by SPC per OMRSD File V, Vol. I, requirement numbers B42GEN.010 and B42GEN.020. (Improper torque, Improper lockwiring)

- o Data review and performance verification during pretest and hotfire operations by USA SRBE per 10REQ-0021 to include: (All Failure Causes)

    - Low speed GN2 spin, para. 2.3.11
    - High speed GN2 spin, para. 2.3.15
    - Hotfire, para. 2.3.16 (includes verification of rock and tilt reservoirs to between 50 and 90 percent)

- o TVC system is inspected for external leaks per 10REQ-0021 following low speed GN2 spin per para. 2.3.11.3, final hydraulics per para. 2.3.12.2, external leaks following high speed GN2 spin per para. 2.3.15.5 and post hotfire inspection per para. 2.3.16.4. (All Failure Causes)

- o Hydraulic fluid purity and particulate count are verified prior to introduction to on-board hydraulic circuits during prelaunch operations per OMRSD File V, Vol. 1, requirement no. B42HP0.010. (Contamination)

- o Prelaunch leak test is witnessed per OMRSD File V, Vol. 1, requirement no. B42HP0.020. (All Failure Causes)

D. FAILURE HISTORY

- o Criticality Category 1:

    - No SRB failure history for this failure mode.

E. OPERATIONAL USE

- o Not applicable to this failure mode.