

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Seals and Sampling Valve (Part of Servoactuator)

PART NO.: 10200-0098-801

FM CODE: A07

ITEM CODE: 20-02-13

REVISION: Basic

CRITICALITY CATEGORY: 1R

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-237

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SHEET 1 OF 5

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FAILURE MODE AND CAUSES: External leakage of hydraulic fluid (System A and/or B) past bleed valve stem seat and cap seal caused by:

- o Defective or damaged stem
- o Defective or damaged stem seat
- o Thread failure
- o Improper torque
- o Contamination
- and -
- o Improper torque
- o Thread failure
- o Improperly lockwired
- o Defective or damaged O-ring
- o Defective or damaged cap sealing surface
- o Contamination

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:

- 1) Pass - Redundancy is verified on new unit
- 2) Fail - Loss of redundancy not detectable
- 3) Fail - Contamination

RATIONALE FOR RETENTION:

A. DESIGN

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

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- o The bleeder valve cap has an O-ring seal which provides redundancy to the internal stem seal to protect against external leakage from an internal source. (Defective or Damaged O-ring and Defective or Damaged Stem Seat)
- o Fluid procurement is controlled by SE-S-0073. (Contamination)
- o All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540, as applicable. (Improper Torque, Improper Lockwired)
- o Stem material is 17-4PH CRES, CH900. (Defective or Damaged Stem)
- o The cap O-ring is made of Viton rubber which was selected for its compatibility with hydraulic oil. (Defective or Damaged O-ring) CN 044
- o Body seat is made of 303 CRES, AMS 5640. (Defective or Damaged Seat, Defective or Damaged Sealing Surface)
- o Assembled parts are cleaned per 10PRC-0620. (Contamination)
- o Manufacturing and initial assembly is controlled per USA SRBE Source Inspection Plan 1390. (All Failure Causes)
- o The Bleeder Valve is scrapped after every flight and replaced with a new one. (All Failure Causes)
- o The hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed specifically to minimize the fire hazard. (Contamination)
- o The aft skirt is purged with GN2 prior to APU start up, reducing the O2 concentration to less than four (4) 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 Controls Qualification Test Report 815. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per Circle Seal Controls ATP T.M. 1068. This includes visual examination, fluid cleanliness verification, fluid leak test for no evidence of leaking, and proof pressure test to 6500 PSIG. (All Failure Causes)
- o Hydraulic system helium leak test to an acceptable level per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)
- o Hydraulic fluid is sampled for purity and particulate count prior to introduction to on-board hydraulic circuits per 10REQ-0021, para. 2.3.2.6. (Contamination)
- o Effluent hydraulic fluid is sampled for water content and particulate count from the rock actuator, the tilt reservoir, the rock reservoir and the tilt actuator per 10REQ-0021, para. 2.3.12.3. (Contamination)

- o Functional test is performed during Hotfire operations per 10REQ-0021 which includes: (All Failure Causes)
 - Low speed GN2 spin, para. 2.3.11
 - High speed spin, para. 2.3.15
 - Hotfire, para.2.3.16
- o Hydraulic fluid is sampled for purity and particulate count prior to introduction to on-board Hydraulic circuits during prelaunch operations per OMRSD File V, Vol. 1, requirement no. B42HP0.010. (Contamination)
- o Hydraulic fluid effluent is sampled for moisture per OMRSD File V, Vol.1, requirement no. B42HP0.011. (Contamination)
- o Prelaunch leak test is performed per OMRSD File V, Vol, 1, requirement no. B42HP0.020.(All Failure Causes)
- o Hydraulic system integrity is monitored from APU start-up to lift off during final countdown per OMRSD File II, Vol. I, requirement number S00FR0.070. (All Failure Causes)
- o Helium is tested for purity and particulate count prior to introduction to on-board circuits per 10REQ-0021, para. 2.3.2.5. (Contamination)

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Vendor acceptance of dimensional conformance is verified by USA SRBE PQAR per SIP 1390. (Defective or Damaged Seat, 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 O-ring).
- o All material certifications are verified by USA SRBE PQAR per SIP 1390. (Stem Failure)
- o Cleanliness of components is verified by USA SRBE PQAR per SIP 1390. (Contamination)
- o Proper torque and lockwire verified by USA SRBE per Moog drawing A239B. (Improper Torque, Improper Lockwired)
- 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, paras. 7.0 and 9.0. (All Failure Causes)
- o Critical Processes/Inspections:
 - Heat Treat per P.B. 104, CH900

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 prior to hotfire per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)
- o Verification of torque and lockwire per 10REQ-0021, para. 2.1.4. (Improper Torque, Improperly Lockwired)
- 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 The water content and particulate count of the effluent hydraulic fluid from the rock actuator, the tilt reservoir, the rock reservoir and the tilt actuator are verified per 10REQ-0021, para. 2.3.12.3. (Contamination)
- 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 Data review and performance verification during 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, 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 Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- o Not applicable to this failure mode.