

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydraulic Bootstrap Reservoir

PART NO.: 10203-0008 FM CODE: A04  
includes:  
Fluid Quantity Transducer:  
1711016-350  
Bleeder Valve, Hydraulic:  
10200-0098-801  
Fittings, Connector:  
10209-0035-801  
10209-0039-801  
Fittings, PPlug, Bleeder:  
MS24391J12L  
MS24391S12L (Alt.)  
MS24391J4L  
MS24391S4L (Alt.)  
Vent Plug:  
Primary MS24391J8L  
Alternate MS24391K8L  
O-rings:  
Type M83248/1

ITEM CODE: 20-01-28B

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 1, 2001

CRITICAL PHASES: Boost

SUPERCEDES: March 31, 2000

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ANALYST: B. Snook/ S. Parvathaneni

SHEET 1 OF 5

APPROVED: S. Parvathaneni

FAILURE MODE AND CAUSES: Internal leakage of hydraulic fluid (Systems A and B) from low pressure fluid to air side at any of one of two seals caused by:

- o Contamination
- o Defective or damaged O-ring/T-seal
- o Defective or damaged sealing surface

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.

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- 2) Pass - Hydraulic fluid reservoir level measurements B58Q1350C, B58Q1351C.
- 3) Fail - Contamination

RATIONALE FOR RETENTION:

A. DESIGN

- o The Hydraulic Bootstrap Reservoir is designed and qualified in accordance with end item specification 10SPC-0052. (All failure causes)
- o O-ring material is Viton which is compatible with hydraulic fluid. (Defective or Damaged O-ring)
- o "T" seals are used with moving surfaces and with O-rings at static seals.(Defective or Damaged Sealing Surface)
- o "T" seal material is a nitrile compound which was specifically formulated for MIL-H-83282 or MIL-PRF-83282 hydraulic fluid. (Defective or Damaged T-Seal)
- o Fluid procurement is controlled per SE-S-0073. (Contamination)
- o Qualification testing verified design requirements as reported in Arkwin Qualification Test Report QTR-1711016-1, Rev. A. (All Failure Causes)
- o Bootstrap cylinder sealing surface is a 16 rms finish. (Defective or Damaged Sealing Surface)

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B. TESTING

- o Acceptance testing is performed per Arkwin ATP 1711016-1 on each flight item at vendor's plant. This includes a visual examination, proof pressure test to 4875 psig on the H.P. side and 165 psig on the L.P. side, operating pressure of  $3125 \pm 125$  psig, and cleanliness. (All Failure Causes)
- o During refurbishment and prior to reuse, the hydraulic reservoir is processed for rework per 10SPC-0131 and acceptance tested per the criteria of 10SPC-0052 at USA SRBE/TBE Florida operations. This includes visual examination, cleanliness verification, proof pressure test to  $4975 \pm 100$  psig supply and 165 psig return, operating pressure of  $3125 \pm 125$  psig, external leakage should be insufficient to form a drop. (All Failure Causes)
- o Hydraulic fluid is verified 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 Effluent hydraulic fluid is verified for moisture content and cleanliness (water content and particulate count) from the rock actuator, the tilt actuator, the tilt reservoir and the rock reservoir per 10REQ-0021, para. 2.3.12.3. (Contamination)

- o Hydraulic fluid is verified 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 Hydraulic cart pressurization GN2 is verified for cleanliness and composition per 10REQ-0021, para. 2.3.2.2. (Contamination)
- o Prelaunch system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (All failure causes)
- o Hydraulic system leak test with helium to an acceptable level per 10REQ-0021, para. 2.3.3.3. (All failure causes)
- 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 Hydraulic fluid level is monitored during test operations: (All Failure Causes)
  - Low speed GN2 spin per 10REQ-0021, para. 2.3.11.1
  - High speed GN2 spin per 10REQ-0021, para. 2.3.15.1
  - Hotfire per 10REQ-0021, para. 2.3.16.1
- o Hydraulic fluid (effluent) is verified for the moisture per OMRSD File V, Vol. 1 Requirement Number B42HP0.011. (Contamination)

## C. INSPECTION

### I. VENDOR RELATED INSPECTIONS

- o Verification of material certifications is performed by USA SRBE PQAR per SIP 1140. (Defective or Damaged Sealing Surface)
- o Verification of Vendor QA dimensional and O-ring sealing surfaces inspections is performed by USA SRBE PQAR per SIP 1140. (Defective or Damaged O-ring)
- o Verification of cleanliness is performed per by USA SRBE PQAR SIP 1140. (Contamination)
- o Witnessing of proof test is performed by USA SRBE PQAR per SIP 1140. (Defective or Damaged O-ring and Defective or Damaged Sealing Surface)
- o Verification of cylinder dimensions is performed by USA SRBE PQAR per SIP 1140. (Defective or Damaged Sealing Surface)

- o Verification of piston seal installation is performed by USA SRBE PQAR per SIP 1140. (Defective or Damaged O-ring)
- o Witnessing of final ATP is performed by USA SRBE PQAR per SIP 1140. (All Failure Causes)
- o Refurbished units are subject to the same ATP standards as new units and requirements are verified per SIP 1140 by USA SRBE PQAR. (All Failure Causes)
- o Critical Processes/Inspections:
  - None

## II. KSC RELATED REFURBISHMENT INSPECTIONS

- o Visual inspection of Boot Strap Reservoir will be performed per 10SPC-0131, para. II. (All Failure Causes)
- o Functional testing of Boot Strap Reservoir will be performed per 10SPC-0131, paragraph IV.

All manual tests will be witnessed by Quality or verified for those instances when controlled software is utilized and a test report is generated. (All Failure Causes)

## III. KSC RELATED ASSEMBLY AND OPERATIONS INSPECTIONS

- 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 O-rings and sealing surfaces are inspected prior to assembly per 10REQ-0021, para. 2.3.0. (Defective or Damaged O-ring and Defective or Damaged Sealing Surface)
- o Helium (influent) cleanliness and composition (purity and particulate count) are verified per 10REQ-0021, para. 2.3.2.5. (Contamination)
- o Hydraulic system leak test with helium to an acceptable level per 10REQ-0021, para. 2.3.3.3. (Defective or Damaged O-ring and Defective or Damaged Sealing Surface)
- o Hydraulic fluid is verified 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 The moisture content and cleanliness (water content and particulate count) of the effluent hydraulic fluid from the rock actuator, the tilt actuator and the tilt reservoir and the rock reservoir are verified per 10REQ-0021, para. 2.3.12.3. (Contamination)

- o Hydraulic fluid cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydraulic circuits during prelaunch operations per OMRSD File V, Vol. 1 Requirement Number B42HP0.010. (Contamination)
- o Effluent hydraulic fluid is verified for moisture per OMRSD File V, Vol. 1 Requirement Number B42HP0.011. (Contamination)
- o Verification of GN2 cleanliness and composition (purity and particulate count) prior to hydraulic system fill and bleed per 10REQ-0021, para. 2.3.2.2. (Contamination)
- o Verification of Hydraulic cart pressurization GN2 for cleanliness and composition (purity and particulate count) per 10REQ-0021, para. 2.3.2.2. (Contamination)
- o Proper function of TVC system is demonstrated 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 Prelaunch hydraulic system leak check per OMRSD File V, Vol. 1 Requirement Number B42HP0.020. (Defective or Damaged O-ring, Defective or Damaged Sealing Surface)

D. FAILURE HISTORY

- o Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- o Not applicable to this failure mode.