

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydraulic Pressure Block Assembly

PART NO.: 10200-0038-102, -103 (Rock) FM Code: A01
10200-0040-102, -103 (Tilt)
10200-0098-801 (Bleed Valve)
10209-0038-801 (Connector Fitting)
Type M83248/1 (O-ring)
10400-0126-801 (Pressure Transducer)

ITEM CODE: 20-01-48

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 1, 2001

CRITICAL PHASES: Final Countdown,
Boost

SUPERCEDES: March 31, 2000

DCN 042
DCN 042

FMEA PAGE NO.: A-154

ANALYST: B. Snook/S. Parvathaneni

SHEET 1 OF 5

APPROVED: S. Parvathaneni

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

- o Contamination
- o Defective or damaged o-ring
- o Defective or damaged sealing surface
- o Improper torque
- o Improperly lockwired
- o Thread failure

FAILURE EFFECT SUMMARY: Fire and explosion will lead to loss of mission, vehicle and crew.

REDUNDANCY SCREENS AND MEASUREMENTS: N/A

RATIONALE FOR RETENTION:

A. DESIGN

- o O-ring material is viton which is compatible with hydraulic fluid. (Contamination)
- o All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540 as applicable. (Improper Torque, Improperly Lockwired)

- o Pressure Block Assembly is assembled from component parts per USA SRBE Drawings 10200-0038 (rock) and 10200-0040 (tilt). (All Failure Causes)
- o The hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to minimize the fire potential. (Contamination)
- o Inlet and outlet connections are MS 33649 fluid bosses with o-ring seals. (Thread Failure)
- o The pressure block is designed to withstand internal proof pressure of 1.5 times maximum operating pressure (4875 psig) and burst pressure of 2.5 times maximum operating pressure (8125 psig). (Defective or Damaged O-ring, Defective or Damaged Sealing Surface and Thread Failure)
- o Pressure Block housing is 304 CRES Condition A (85000 lb/in² tensile) (Defective or damaged sealing surface)
- o The aft skirt area is purged with GN2 prior to APU startup. This reduces the O₂ 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 NASA Qualification Test Report TM-78258. (All Failure Causes)
- o Stress Analysis Report JRM-016-92-E dated May 8, 1992 shows Factor of Safety (F.S.)- Yield = 3.30 and F.S. (Ultimate) = 8.45 for the pressure block. Each pressure block is checked for leakage during system level test. The high factors of safety indicates that the hydraulic pressure block assemblies have adequate safe life and do not require proof testing (ECP 3270). (All Failure Causes)

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B. TESTING

- 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 Helium leak test is witnessed by USA SRBE per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)
- o Visual leak check of hydraulic circuit (system) joints is performed prior to hotfire 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 Effluent hydraulic fluid is sampled for moisture content and cleanliness (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 Para. 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 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 Hydraulic fluid (effluent) is sampled for moisture per OMRSD File V, Vol. 1 Requirement Number B42HP0.011. (Contamination)
- o The above referenced OMRSD testing is performed every flight.

C. INSPECTION

I VENDOR RELATED INSPECTIONS

- o Verification of all pressure block sealing surfaces vendor inspections by USA SRBE PQAR per SIP 1373. (Defective or Damaged Sealing Surface)
- o Verification of material certification for pressure block by USA SRBE PQAR per SIP 1373 (Defective or damaged sealing surface)
- o Verification of all parts meeting print requirements by USA SRBE PQAR per SIP 1373. (Defective or Damaged Sealing Surface, Thread Failure)
- o Verification of bleed valve material certification by USA SRBE PQAR per SIP 1390, (Defective or Damaged Sealing Surface)
- o Verification of threads per SIP 1390. (Damaged Threads)
- o Critical Processes/Inspections:
 - Heat-Treat, pressure block per QQ-S-763.

II KSC RELATED REFURBISHMENT INSPECTION

- o Visual inspection of FSM will be performed per 10SPC-0131, para. II. (All Failure Causes)

III KSC RELATED ASSEMBLY AND OPERATIONS INSPECTIONS

- o O-Rings are inspected prior to installation for absence of physical defects per 10REQ-0021, para. 2.3.0. (Defective or Damaged O-ring)
- o Sealing surfaces are inspected prior to installation verifying no contaminant or obstruction exists per 10REQ-0021, para. 2.3.0. (Defective or Damaged Sealing Surface)

- o Verify proper torque per 10REQ-0021, para. 2.1.4. (Improper Torque)
- o Verify proper lockwire per 10REQ-0021, para. 2.1.4. (Improperly Lockwired)
- o Hydraulic fluid cleanliness and composition (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 moisture content and cleanliness (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 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 Helium leak test is witnessed by USA SRBE per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)
- o Performance of visual leak check of hydraulic circuit (system) joints per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)
- o Verify Rock Hydraulic Reservoir level is greater than 30 percent during low speed GN2 spin per 10REQ-0021, para. 2.3.11.2. (All Failure Causes)
- o Verify Tilt Hydraulic Reservoir level is greater than 30 percent during low speed GN2 spin per 10REQ-0021, para. 2.3.11.2. (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 Proper function of TVC system is verified during Hotfire operations per 10REQ-0021, para. 2.3.11, 2.3.15, and 2.3.16 respectively for: (All Failure Causes)
 - Low speed GN2 spin
 - High speed GN2 spin
 - Hotfire (Includes verification of Rock and Tilt Reservoirs between 50 and 90 percent)
- o TVC system is inspected for external leaks per 10REQ-0021, para. 2.3.11.3, 2.3.15.5, and 2.3.16.4 respectively, following low speed GN2 spin, high speed GN2 spin, and post hotfire inspection. (All Failure Causes)
- 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 Prelaunch hydraulic system leak test is verified per OMRSD File V, Vol. 1 Requirement Number 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.