

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydraulic Pump

PART NO.: 10201-0051-801, -802 (Alt.) FM CODE: A08
10209-0038-801 (Fitting)
10209-0036-801 (Fitting)
10209-0077-801 (Fitting)
M83248/1 (O-Ring)
MS 24391 J4L (Plug)

ITEM CODE: 20-01-29 REVISION: Basic

CRITICALITY CATEGORY: 1 REACTION TIME: Seconds

NO. REQUIRED: 2 DATE: March 1, 2002

CRITICAL PHASES: Final Countdown, Boost SUPERCEDES: March 1, 2001

FMEA PAGE NO.: A-110 ANALYST: B. Snook/S. Finnegan

SHEET 1 OF 5 APPROVED: S. Parvathaneni

CN 044

FAILURE MODE AND CAUSES: External leakage of hydraulic fluid (System A and/or B) at any one of five fitting seals (O-rings) or any one of eight housing seals (O-rings) or at one Lee plug, caused by:

- o Defective or damaged O-rings
- o Defective or damaged sealing surfaces
- o Improper torque
- o Improperly lockwired
- o Thread failure
- o Contamination

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 The Hydraulic Pump is designed and qualified in accordance with end item specification 10SPC-0053. (All failure causes)
- o O-ring material is Viton, selected for its compatibility with hydraulic fluid. (Contamination)
- o O-rings are static seals. (Defective or Damaged O-ring)

- o O-Ring static seal glands are per MIL-G-5514 (Defective or Damaged Sealing Surface)
- o Housing sections are machined surfaces with O-ring seals and bolted mountings. (Defective or damaged Sealing Surface)
- o Housing bolts are torqued and lockwired. (Improper Torque and Improperly Lockwired)
- o Threaded inserts installed per MS 33537. (Thread Failure)
- o Threaded bosses are per MS 33649. (Thread Failure)
- o Hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to minimize fire hazard. (Contamination)
- o Port Cap Lee plug is a two piece interference fit plug assembly. (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 ABEX Qualification Test Report AER-729. (All Failure Causes)
- o Fluid procurement is controlled per SE-S-0073. (Contamination)
- o All threaded fittings and connectors are torqued per engineering specifications and lockwired per MS 33540 as applicable. (Improper Torque, Improperly Lockwired)

B. TESTING

- o Acceptance test is performed per ABEX ATP TP-675 on each new flight item. This includes visual examination, electrodepressurization valve test, break in run, overspeed test to 4755 rpm, proof pressure test, functional test, leakage test for no external leakage except one drop in 5 minutes at shaft seal, depressurized start and pressurization. (All Failure Causes)
- o Proof pressure testing consists of 300 psi on inlet port and case drain port and 4875 psi to the discharge port. (Defective or Damaged O-rings and Defective or Damaged Sealing Surfaces)
- o During refurbishment, the pump is reworked per 10SPC-0131 and tested per ATP TP-675 to ensure proper operations. (All Failure Causes)
- 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 verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board flight hardware per 10REQ-0021, para. 2.3.2.6. (Contamination)
- o Visual leak check of hydraulic circuit (system) joints is performed per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)
- o Helium is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board flight hardware per 10REQ-0021, para. 2.3.2.5. (Contamination)
- o Proper operation of the pump is verified by test per 10REQ-0021 (OMI B1511) during: (All Failure Causes)
 - Low speed spin, para. 2.3.11
 - High speed spin, para. 2.3.15
 - Hotfire, para. 2.3.16
- o Post hotfire verification, including inspection and leak check per 10REQ-0021, para. 2.3.16.4. (All Failure Causes)
- 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 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 verified for content of moisture per OMRSD File V, Vol. 1, Requirement Number B42HP0.011. (Contamination)

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Verification of lockwire by USA SRBE PQAR per SIP 1258. (Improperly Lockwired)
- o Verification of torque operations by USA SRBE PQAR per SIP 1258. (Improper Torque)
- o Verification of ABEX buy-off of O-ring installation by USA SRBE PQAR per SIP 1258. (Defective or Damaged Sealing Surface)
- o Nondestructive Evaluation (NDE) is performed on subassemblies by USA SRBE PQAR per SIP 1258. (Defective or Damaged Sealing Surface)

- o Witnessing of acceptance testing by USA SRBE PQAR per SIP 1258. (All Failure Causes)
- o Verification of vendor buyoff of external sealing surface by USA SRBE PQAR per SIP 1258. (Defective or Damaged Sealing Surfaces)
- o Verification that Parker Abex has performed and accepted all required Hydraulic Pump refurbishment and inspections per TP-1210 by USA SRBE PQAR per SIP 1258. (All Failure Causes) CN 044
- o Critical Processes/Inspections:
 - Penetrant inspection per ASTM E1417

KSC RELATED INSPECTIONS

- o O-Rings, K-Seals and E-Seals (as applicable) 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 Verification of pump connectors torque and lockwire by USA SRBE per 10REQ0021, requirement number 2.1.4. (Improper Torque, Improperly Lockwired)
- o Hydraulic system helium leak test is performed per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)
- o Hydraulic fluid cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board flight hardware per 10REQ-0021, para. 2.3.2.6. (Contamination)
- o Helium cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board flight hardware per 10REQ0021, para. 2.3.2.5. (Contamination)
- o Hydraulic circuit fluid leak test is performed per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (All Failure Causes)
- o Proper function of TVC system is demonstrated during Hotfire operations 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

- o TVC System is inspected for external leaks per 10REQ-0021 following low speed GN2 spin, para. 2.3.11.3, high speed GN2 spin, para. 2.3.15.5, and post Hotfire inspection, para. 2.3.16.4. (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 Verification of hydraulic fluid (effluent) sampled for moisture per OMRSD File V, Vol. 1, Requirement Number B42HP0.011. (Contamination)
- o Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (All Failure Causes)
- o Post hotfire inspection for evidence of leakage per 10REQ-0021, para. 2.3.16.4. (Defective or Damaged Sealing Surface, Thread Failure)

D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.