

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydraulic Pump

PART NO.: 10201-0051-801, -802(Alt.) FM CODE: A10
10209-0036-801 (Fitting)
10209-0038-801 (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-112 ANALYST: B. Snook/S. Finnegan

SHEET 1 OF 4 APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: Rupture caused by:

- o Material defect
- o Manufacturing defect

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 The pump housing is A356-T6 aluminum alloy. (Material Defect)
- o The housing is hard coated for corrosion resistance. (Material Defect)
- o Material meets the requirements of MSFC-SPEC-522A. (Material Defect)
- 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 During qualification testing, the inlet was pressurized to 500 psig, the case drain was pressurized to 640 psig and the outlet port was pressurized to 10,160 psig, all without failure, which is in excess of three times operating pressure. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per ABEX ATP TP-675 on each flight item. This includes visual examination, 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 (per 10SPC-0053) consists of following: (All failure causes)
 - Pressure (outlet): 4875 (PSIG)
 - Suction (inlet) : 300 (PSIG)
 - Case Drain : 300 (PSIG)
- o During refurbishment, the pump is reworked per 10SPC-0131 and tested per ATP TP-675 to ensure proper operations. (All Failure Causes)
- o Proper operation of the pump is verified by test per 10REQ-0021 during: (All Failure Causes)
 - Low speed spin per para. 2.3.11
 - High speed spin per para. 2.3.15
 - Hotfire per para. 2.3.16
- o Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (All Failure Causes)
- 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. (Material Defects)
- o Hydraulic system helium leak test is performed per 10REQ-0021, para. 2.3.3.3 prior to hotfire. (All Failure Causes)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTIONS

- o Witnessing of acceptance testing by USA SRBE PQAR per SIP 1258. (All Failure Causes)
- 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)
- o Critical Processes/Inspections:
 - Penetrant inspection per ASTM E1417
 - Anodize per MIL-A-8625

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KSC RELATED INSPECTIONS

- 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 Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (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 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 (which includes verification of rock and tilt reservoirs between 50 and 90 percent), para. 2.3.16.

- o Helium cleanliness and composition (purity and particulate count) are verified prior to introduction on-board the flight hardware per 10REQ-0021, para. 2.3.2.5. (Material defects)
- 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 and during prelaunch per OMRSD File V, Vol. I, requirement number B42HP0.010. (Material defects)
- o Verification of hydraulic fluid (effluent) sampled for moisture and dissolved air content per OMRSD File V, Vol. I, requirement number B42HP0.011 and .070 respectively. (Material defects)
- o Pump housing integrity is verified during post GN2 spin and hotfire inspections per 10REQ-0021 para. 2.3.11.3, 2.3.15.5, and 2.3.16.4. (All Failure Causes)
- o Visual inspection for hydraulic circuit fluid leaks is performed per 10REQ-0021 para. 2.3.12.2 prior to hotfire. (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.