

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydraulic Accumulator and GN2 Charging Assembly

PART NO.: 10207-0002-803

FM CODE: A09

ITEM CODE: 20-01-49

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 1, 2001

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 2000

FMEA PAGE NO.: A-169

ANALYST: B. Snook/S. Parvathaneni

SHEET 1 OF 5

APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: Rupture of accumulator shell caused by:

- o Material defects
- o Manufacturing defects

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 Accumulator and GN2 Charging Assembly is designed and qualified in accordance with end item specification 10SPC-0051. (All Failure Causes)
- o The accumulator is designed for a proof pressure of two times operating pressure (6500 psig) and a burst pressure of four times operating pressure (13,000 psig). During qualification testing, the accumulator was pressurized to 16,250 psig without failure. (All Failure Causes)
- o Fittings are lockwired per MS33540 with Monel lockwire. (Manufacturing Defect)
- o The accumulator shell and end cap are 15-5 PH CRES heat treated to H1025 for a hardness of C35-37 (155-175 ksi). (Material Defect)
- o The accumulator shell bore is glass bead peened with .002-.004 inch diameter glass beads to a 12-16 microinch finish. (Manufacturing Defect)
- o Hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to minimize the fire hazard. (Material Defect)
- o Material selection is per MSFC-SPEC-522A. (Material Defects)
- o The accumulator shell and end cap are designated fracture critical per FCP5790001, Rev. B. (Material Defect, Manufacturing Defect)

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- o Aft skirt area is purged with GN2 prior to APU start. 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 Parker-Hannifin Qualification Test Report QTR 5790001, Rev. NC. (All Failure Causes)

B. TESTING

- o Designed burst was verified during qualification testing. (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.
- o Acceptance testing is performed per Parker-Hannifin ATP PTS 5790001 at vendor's plant. This includes visual examination, proof pressure test to 6500 psig, performance and leakage tests, bonding and cleanliness. (All Failure Causes)
- o Acceptance testing of the high pressure GN2 charging valve is per Parker PTS 5800002 at vendor's plant. This includes visual examination, proof pressure test to 6600 ± 100 psig and no external leakage at 3300 ± 50 psig, cleanliness and post test examination and installation verification. (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 During refurbishment and prior to reuse the accumulator is processed for rework per 10SPC-0131 and acceptance tested per the criteria of 10SPC-0051 by USA SRBE/TBE Florida operations. This includes visual examination, proof pressure test 6500 psig, leakage tests, bonding and cleanliness. (All Failure Causes)
- o Hydraulic circuit fluid leak test is performed per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (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 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 Helium leak test to less than 1×10^{-4} sccs is performed per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- o Source Inspection Plan SIP 1125 verifies proper manufacturing and assembly. (Manufacturing Defects)
- o Witnessing of charging valve acceptance test by USA SRBE PQAR per SIP 1125. (All Failure Causes)
- o Verification of material certifications by USA SRBE PQAR per SIP 1125. (Material Defects)
- o Verification of leakage tests by USA SRBE PQAR per SIP 1125. (All Failure Causes)
- o Witnessing of accumulator acceptance test by USA SRBE PQAR per SIP 1125. (All Failure Causes)
- o Critical Processes/Inspections:
 - Heat treat per MIL-H-6875.
 - Anodize per MIL-A-8625.
 - Glass Bead Peening per MIL-STD-852
 - Tube Bending per 10PRC-0038.

II. KSC RELATED REFURBISHMENT INSPECTION

- o Visual inspection of accumulator will be performed per 10SPC-0131, para. II. (All Failure Causes)
- o Functional testing of accumulator 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 Hydraulic system helium leak test is verified per 10REQ-0021, para. 2.3.3.3. (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 per 10REQ-0021, para. 2.3.16 (includes verification of rock and tilt reservoirs between 50 and 90 percent). (All Failure Causes)
- o Post hotfire inspection and leak check per 10REQ-0021, para. 2.3.16.4. (All Failure Causes)
- 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.
- 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 GN2 cleanliness and composition (purity and particulate count) are verified prior to introduction to on board flight hardware per 10REQ-0021, para. 2.3.2.2 and OMRSD File V, Vol. I, requirement number B42AP0.012. (Material Defects)
- o Prelaunch hydraulic system leak test is witnessed per OMRSD File V, Vol. 1 Requirement Number B42HP0.020. (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 Hydraulic circuit fluid leak test is witnessed per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (All Failure Causes)
- 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 GN2spin, high speed GN2 spin, and post hotfire inspection. (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.