SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydraulic Accumulator (Alternate)

PART NO.: 10207-0029-801
(Interchangeable with 10207-0002-803)
10209-0035-801 (Fitting Connector)
Type M83248/1 (O-ring)

FM CODE: A01

ITEM CODE: 20-01-49A

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 1, 2001 DCN 042

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 2000 DCN 042

FMEA PAGE NO.: A-170

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 one fitting o-ring caused by:

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

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

- The Hydraulic Accumulator is designed and qualified in accordance with end item specification 10SPC-0150. (All Failure Causes)

- 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). Actual burst during Qual test occurred at 16,750 psig. (Thread Failure, Defective or Damaged Sealing Surface)

- o Fittings are lockwired per MS33540. (Improperly Lockwired)
- o Hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to minimize the fire hazard. (Contamination)

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- o Threaded port is per MS33649. (Thread Failure)
- o Port is designed to withstand 750 in-lb torque without distortion or failure. (Improper Torque)
- o Fluid procurement is controlled by SE-S-0073. (Contamination)
- o The aft skirt area is purged with GN2 prior to APU start. This reduces the 02 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 Metal Bellows Qualification Test Report CR 1258, Rev. Basic. (All Failure Causes)

B. TESTING

- o Designed burst was verified during qualification testing. (Thread Failure, Defective or Damaged Sealing Surface)
- o Acceptance testing is performed per Metal Bellows ATP 83376. This includes visual examination, proof pressure test to 6500 psig, performance and leakage tests, and cleanliness. (All Failure Causes)
- o During refurbishment and prior to reuse the accumulator is reworked per 10SPC-0131 and acceptance tested by USA SRBE/TBE Florida operations per the criteria of 10SPC-0150. This includes visual examination, proof pressure test to 6540 $\pm$ 40 psig with leakage insufficient to form a liquid drop or no permanent deformation, electrical bonding test and cleanliness verification. (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 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 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 Visual leak check of hydraulic circuit (system) joints is performed per 10REQ-0021, para. 2.3.12.2. (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 Helium leak test to less than 1×10^{-4} sccs is performed per 10REQ-0021, para. 2.3.3.3. (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 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

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- o Witnessing of acceptance test by USA SRBE PQAR per SIP 1327. (All Failure Causes)

- o Refurbishment units are subject to the same inspection and test verification by USA SRBE PQAR as new units per SIP 1327. (All Failure Causes)

- o Verification of contamination control by USA SRBE PQAR per SIP 1327. (Contamination)

- o Verification of threads by USA SRBE PQAR per SIP 1327. (Thread Failure)

- o Critical Processes/Inspections:

  - None

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 Lockwire is verified per 10REQ-0021, para. 2.1.4. (Improperly Lockwired)

- o Hydraulic system helium leak test is witnessed/verified per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)

- o Hydraulic circuit fluid leak test is witnessed/verified per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (All Failure Causes)

- 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)

- 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)

- 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)

- 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)

- 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)

- Prelaunch hydraulic system leak check is witnessed per OMRSD File V, Vol. 1 Requirement Number B42HP0.020. (All Failure Causes)

- 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)

- 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)

- 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)
- 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)

- 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)

- 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)

- Performance of visual leak check of hydraulic circuit (system) joints per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)

D. FAILURE HISTORY

- Criticality category 1:

  - No SRB failure history for this failure mode.

E. OPERATIONAL USE

- Not applicable to this failure mode.

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