SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Check Valve and Filter Assembly (CVFA)

PART NO.: 10201-0047-802
10201-0047-803 (Alt.)
Includes

Fittings, Connector
10209-0038-801
10209-0106-801
10209-0157-801 (Alt.)
10209-0105-801
10209-0067-801 or
10209-0132-801 (Alt.)
O-rings
Type M83248/1

FM CODE: A05

ITEM CODE: 20-01-30

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 1, 2001 CN 042

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 2000 CN 042

FMEA PAGE NO.: A-118

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 five fitting O-rings or one plug O-ring or filter housing O-ring caused by:

- Contamination
- Defective or damaged o-ring
- Improper torque
- Thread failure
- Improperly lock wired
- 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 Check Valve and Filter Assembly is designed and qualified in accordance with end item specification 10SPC-0048. (All Failure Causes)
- CVFA is designed for proof pressure of 1.5 times operating pressure and burst pressure of 2.5 times operating pressure. (Thread Failure)
- O-ring material is Viton which is compatable with MIL-H-83282 hydraulic fluid. (Contamination)
- All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540. (Improper Torque, Improperly Lockwire)
- Inlet, outlet, indicator and bleed ports are MS33649 fluid bosses. Threads for case/housing interface are per MIL-S-8879. (Thread Failure)
- Thread fittings are 6AL-4V Titanium. (Thread Failure)
- Filter case is torqued to engineering specification to ensure O-ring sealing and lockwired. (Improper Torque)
- Dyantube fittings are 6AL-4V Titanium. (Thread Failure)
- Hydraulic fluid is per MIL-H-83282 or MIL-PRF-83282. (Contamination)

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- The aft skirt area is purged with GN2 prior to APU start up. This reduces the O^2 concentration to less than four percent per OMRSD File II, Vol. 1, requirement number SOOFMO.430. (All Failure Causes)
- Component design cleaning, testing and handling are per 10SPC-0048. (Contamination)
- Qualification testing verified design requirements as reported in Purolator Technologies Qualification Test Report No. 11362. (All Failure Causes)
- Fluid procurement is controlled per SE-S-0073. (Contamination)

B. TESTING

- Acceptance testing is performed per PTI, PAT 7588778 on each new flight article. This includes visual examination, proof pressure test to 4875 psig, external leakage, operational leak check and cleanliness. (All Failure Causes)
- During refurbishment and prior to use, Check Valve and Filter Assembly is reworked per 10SPC-0131 and acceptance tested by USA SRBE/TBE Florida Operations per the criteria of 10SPC-0048. This includes visual examination, proof pressure test to 4975 +/- 100 psig, external leakage and operational leak check for five minutes at 3300 ± 50 psig to verify leakage is less than that required to form a drop, and cleanliness verification (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 Hydraulic circuit fluid leak test is performed per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (All Failure Causes)

- o CVFA is exposed to operating pressure during hotfire test operations per 10REQ-0021 which includes: (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 Hydraulic fluid is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board the flight hardware during prelaunch operations per OMRSD File V, Vol. 1, requirement number B42HPO.010. (Contamination)

- o Helium is verified for cleanliness and composition (purity and particulate count) prior introduction to on-board the flight hardware per 10REQ-0021, para. 2.3.2.5. (Contamination)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- o Verification of material certifications by USA SRBE PQAR per SIP 1264. (Thread Failure and Defective or Damaged Sealing Surface)

- o Verification of assembly by USA SRBE PQAR per SIP 1264. (All Failure Causes)

- o Witnessing and verification of proper torque by USA SRBE PQAR per SIP 1264. (Improper Torque)

- o Verification of vendor buyoff of sealing surfaces by USA SRBE PQAR per SIP 1264. (Defective or Damaged Sealing Surface)

- o Verification of vendor buyoff of o-ring installation by USA SRBE PQAR per SIP 1264. (Defective or Damaged O-Ring)

- o Verification of contamination check by USA SRBE PQAR per SIP 1264. (Contamination)

- o Verification of lockwire by USA SRBE PQAR per SIP 1264. (Improperly Lockwired)

- o Witnessing of acceptance test by USA SRBE PQAR per SIP 1264. (All Failure Causes)
- o Refurbished hardware is reworked and inspected per SIP 1264 by USA SRBE PQAR. (All Failure Causes)
- o Verify threads per SIP 1264. (Thread Failures)
- o Critical processes/Inspections:
  - None

II. KSC RELATED REFURBISHMENT INSPECTION

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

- 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 During installation, torque is witnessed per 10REQ-0021, para. 2.1.4. (Improper Torque)
- o Lockwire installation is verified per 10REQ-0021, para. 2.1.4. (Improper Lockwired)
- o Helium (influent) cleanliness and composition (purity and particulate count) is verified per 10REQ-0021, para. 2.3.2.5. (Contamination)
- o Performance of visual leak check of hydraulic circuit (system) joints per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)
- o Hydraulic fluid cleanliness and composition (purity and particulate count) are verified prior to introduction on-board the flight hardware per 10REQ-0021, para. 2.3.2.6. (Contamination)

- 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. (Contamination)

- Hydraulic circuit fluid leak test is verified per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)

- Verify Rock Hydraulic Reservoir level is greater than 30 percent during low speed 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 demonstrated during Hotfire operations per 10REQ-0021 to include low speed GN2 spin, para. 2.3.11, high speed GN2 spin, para. 2.3.15 and hotfire, para 2.3.16. (Rock and Tilt Reservoir Level Are Each Between 50 and 90 Percent) (All Failure Causes)

- Inspections for leaks, rubbing and discoloration are conducted per 10REQ-0021 following low speed GN2 spin, para. 2.3.11.3 and high speed GN2 spin, para. 2.3.15.5. (All Failure Causes)

- Post hotfire inspection for leaks and damage is performed per 10REQ-0021, para. 2.3.16.4. (All Failure Causes)

- Hydraulic fluid cleanliness and composition (purity and particulate count) are verified prior to introduction on-board Hydraulic circuits during prelaunch operations per OMRSD File V, Vol. 1, Requirement Number B42HP0.010.(Contamination)

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

D. FAILURE HISTORY

CRITICALITY 1:

- Failure: Very minor leak at Port B Nut during SIT (PR PV6002874 dated March, 1984).

  Cause: Improper fitting seal.

  Corrective Action: Due to the minor nature of the leak, a waiver was requested.

E. OPERATIONAL USE

- Not applicable to this failure mode.