SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fluid Manifold Assembly

PART NO: 10201-0066-102
10201-0098-801 (alt.)

FM CODE: A10

ITEM CODE: 20-01-47

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NUMBER REQUIRED: 2

DATE: March 31, 2000 CN 038

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 1997 CN 038

FMEA PAGE NUMBER: A-153

ANALYST: B. Snook/S. Parvathaneni CN 038

SHEET 1 OF 4

APPROVED: S. Parvathaneni CN 038

FAILURE MODE AND CAUSES: Rupture (System A and/or B) caused by:

- Material defect
- 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

- The Fluid Manifold Assembly is designed and qualified in accordance with end item specification 10SPC-0054. (All Failure Causes)

- The manifold is pressure relieved at 3650 to 3850 psig on the high pressure side and 80-125 psig on the low pressure side. (All Failure Causes)

- The manifold and high pressure relief valve are designed for a proof pressure of 1.5 times operating pressure and a burst pressure of 2.5 times operating pressure. (All Failure Causes)

- The manifold material selection is per MSFC-SPEC-522A. The manifold body is 304 CRES, and spare port plugs are nitronic 60. (Material Defect)

- High pressure relief valve material selection is per MSFC-SPEC-522A. Housing material is nitronic 40 stainless. Body and adjusting screw material is 304 CRES. (Material Defect)

- All threaded fittings are torqued per engineering specification. (Manufacturing Defect)
- Proper manufacturing is verified by a source inspection plan. (Manufacturing Defect)
- The filter flange is 304L CRES, mounting bolts are 321/347 CRES. (Material Defect)
- The aft skirt is purged with GN2 prior to APU startup. This reduces the 02 concentration to less than four percent per OMRSD File II, Vol. 1, requirement number S00FM0.430. (All Failure Causes)
- Qualification testing verified design requirements as reported in Pneudraulics, Inc. Qualification Test Report QTR 8090, Rev. A or Wright Components QTR 80335A for the alternate manifold. (All Failure Causes)

B. TESTING

- Acceptance testing of the high pressure relief valve is performed per Pneudraulics ATP 1674-1 or Wright Components ATP-11355 for the alternate manifold. This includes a visual examination, proof pressure to 4875 psig and crack and reseat pressure. (All Failure Causes)
- Acceptance testing of the fluid manifold assembly is performed per Wright Components ATP-15980 at vendor's plant. This includes a visual examination, filter element assembly, proof pressure testing to 4875 psig on the HP side, crack and reseat pressures and external leakage should be insufficient to form a liquid drop. (All Failure Causes)
- During refurbishment and prior to reuse, the manifold assembly is processed for rework per 10SPC-0131 and acceptance tested per the criteria of 10SPC-0054 at USA SRBE/TBE Florida operations. This includes a visual examination, proof pressure testing to 4975 $\pm$ 100 psig on the H.P. side and between 1350 psig to 140 psig minimum on the L.P. side, verification of crack and reseat pressures, and external leakage less than that required to form a liquid drop. (All Failure Causes)
- After installation, the manifold is leak checked with helium to an acceptable level per 10REQ-0021, Para. 2.3.3.3. (All FailureCauses)
- Hydraulic circuit fluid leak test is performed per 10REQ-0021, Para. 2.3.12.2 prior to hotfire. (All Failure Causes)
- Visual leak check of hydraulic circuit (system) joints is performed per 10REQ-0021, Para. 2.3.12.2.. (All Failure Causes)
- TVC System 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 Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (All Failure Causes)

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- o Verification and review of as-built configuration by USA SRBE PQAR per SIP 1252 or SIP 1298. (Manufacturing Defect)
- o Witnessing of manifold assembly acceptance test by USA SRBE PQAR per SIP 1252 or SIP 1298. (All Failure Causes)
- o On refurbished manifolds, verifications of post flight inspections and testing by USA SRBE PQAR per SIP 1252 or SIP 1298. (All Failure Causes)
- o Verification of material requirements and testing for the HPRV and LPRV by USA SRBE PQAR per SIP 1259 or SIP 1298. (Material Defects)
- o Witnessing of proof pressure testing of HPRV and LPRV by USA SRBE PQAR per SIP 1259 or SIP 1298. (All Failure Causes)

Critical Processes/Inspections:

- o Heat treat manifold body per QQ-S-763

II. KSC RELATED REFURBISHMENT INSPECTION

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

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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 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 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 demonstrated 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 (includes verification of Rock and Tilt Reservoirs between 50 and 90 percent)

- Hydrualic fluid is verified for cleanliness and composition (purity and particulate count) prior to introduction on board the 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)

- Verification of hydraulic fluid (effluent) sampled for moisture and disolved air content per OMRSD File V, Vol. I, requirement number B42HP0.011 and .070 respectively. (Material Defects)

- Helium cleanliness and composition (purity and particulate count) are verified prior to introduction to on board flight hardware per 10REQ-0021, para. 2.3.2.5. (Material Defects)

- 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 GN2 spin, highspeed GN2 spin, and post hotfire inspection. (All Failure Causes)

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

D. FAILURE HISTORY

- Criticality Category 1:

  - Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

  - Not applicable to this failure mode.