

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Fluid Manifold Assembly

PART NO.: 10201-0066-102 FM CODE: A01
10201-0098-801 (Alternate)

ITEM CODE: 20-01-47 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-142 ANALYST: B. Snook/S. Finnegan

SHEET 1 OF 6 APPROVED: S. Parvathaneni

CN 044

FAILURE MODE AND CAUSES: External leakage of hydraulic fluid (System A and/or B) at any one of twelve fitting O-rings or adapter fitting o-ring or manifold spacer O-ring (tilt) or filter flange O-ring or HPRV housing to manifold body O-ring or HPRV retainer to valve body O-ring or HPRV adjusting screw to valve body O-ring caused by:

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

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 Fluid Manifold Assembly is designed and qualified in accordance with end item specification 10SPC-0054. (All Failure Causes)
- o Inlet and outlet port connections are MS 33649 fluid bosses employing O-ring seals between the fluid fitting and the boss. (Thread Failure)
- o The case drain filter assembly is sealed with an O-ring and the end cap is secured to the manifold body with four hex head machine screws. (Defective or Damaged Sealing Surface)

- o The high pressure relief valve assembly is threaded to the manifold body and sealed with an O-ring. (Thread Failure)
- o The fitting adapter, filter element, H.P. relief valve, L.P. relief valve cartridge and spare plugs are installed and torqued and tested per ATP-15980 for the alternate manifold at vendor's plant. During refurbishment at USA SRBE Florida operations these parts are installed and torqued per 10SPC-0131. (Improper Torque)
- o Fittings are lockwired per MS 33540. (Improper Lockwired)
- o The high pressure relief valve housing is sealed to the valve body with an O-ring and back up O-ring. (Defective or Damaged O-ring and Defective or Damaged Sealing Surface)
- o The high pressure relief valve adjusting screw is threaded to the valve body and is sealed with an O-ring. (Thread Failure)
- o The manifold spacer, which is found on the tilt system only, is sealed with an O-ring. (Defective or Damaged Sealing Surface)
- o O-ring material is viton (AMS-R-83248) which is compatible with hydraulic fluid (MIL-H-83282). (Contamination) CN 044
- o Hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to reduce the potential of fire. (Contamination)
- o Fluid procurement is controlled by SE-S-0073. (Contamination)
- o The aft skirt area is purged with GN2 prior to APU start up. 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 Pneudraulic, Inc. Qualification Test Report QTR 8090, Rev. A or Wright Components QTR 80335A for the alternate manifold. (All Failure Causes)
- o To prevent damaged or defective sealing surfaces all fitting bosses on manifold block are per MS 33649. (Defective or Damaged Surface)
- o Sealing surfaces for H.P. relief valve, case drain filter and adapter fitting are per MIL-G-5514. (Defective or Damaged Surface)
- o Case drain filter, adapter, fitting, and H.P. relief valve body, housing, and adjusting screw sealing surfaces and glands are per MIL-G-5514. (Defective or Damaged Surfaces)
- o Manifold block and components are cleaned, tested, and handled per the requirements of 10PRC-0620. (Contamination)

B. TESTING

- o Acceptance testing is performed per Wright Components ATP-15980 at vendor's plant. This includes visual examination, cleanliness, proof

pressure testing to 4875 psig on HP side and 1300 psig on LP side, external leakage to less than that which is required to form a liquid drop, and cleanliness. (All Failure Causes)

- o During refurbishment and prior to reuse the Fluid 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 visual examination, cleanliness verification, proof pressure testing to 4975 ± 100 psig on the H.P. side and low pressure chamber pressure is maintained between 1350 and 140 psig, and leak test for five minutes at 3300 ± 50 psig supply 70 ± 5 psig return with leakage insufficient to form a liquid drop. (All failure causes)
- o Acceptance testing of the H.P. relief valve is performed per Pneudraulics ATP 1674-1 or Wright Components ATP 11355 for the alternate manifold. This includes visual examination, cleanliness, proof pressure to 4875 psig and post test cleanliness. (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 circuits per 10REQ-0021, Para. 2.3.2.5. (Contamination)
- o Upon installation, hydraulic system is leak tested with helium to an acceptable level per 10REQ-0021, Para. 2.3.3.3. (All Failure Causes)
- 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 Effluent hydraulic fluid is verified for moisture content and cleanliness (water content and particulate count) from the rock actuator, the tilt actuator, the tilt reservoir and the rock reservoir per 10REQ-0021, Para. 2.3.12.3. (Contamination)
- o Hydraulic circuit fluid leak test is performed per 10REQ-0021, Para. 2.3.12.2, prior to hotfire. (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 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 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 of thread connections by USA SRBE PQAR per SIP 1252 or SIP 1298. (Thread Failure)
- o Verification of crack and reseal pressure tests by USA SRBE PQAR per SIP 1252 or SIP 1298. (Contamination)
- o Verification of final cleaning by USA SRBE PQAR per SIP 1252 or SIP 1298.(Contamination)
- o Witnessing of Acceptance Test by USA SRBE PQAR per SIP 1252 or SIP 1298. (All Failure Causes)
- o Verification of refurbished units acceptance data pack by USA SRBE PQAR per SIP 1252 or SIP 1298. (All Failure Causes)
- o Critical Processes/Inspections:
 - None

II. KSC RELATED REFURBISHMENT INSPECTION

- 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)

III. KSC RELATED ASSEMBLY AND OPERATIONS INSPECTIONS

- o Installation and torque witnessed per 10REQ-0021, para. 2.1.4. (Improper Torque)
- o Lockwire is verified per 10REQ-0021, para. 2.1.4. (Improperly Lockwired)
- 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, by USA SRBE, prior to installation verifying no contaminant or obstruction exists per 10REQ-0021, para. 2.3.0. (Defective or Damaged Sealing Surface)
- o Torque and lockwire of fitting connectors is witnessed per 10REQ-0021, para. 2.1.4. (Improper Torque, Improperly Lockwired)
- 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. (Contamination)
- o 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)
- o Performance of visual leak check of hydraulic circuit (system) joints per 10REQ-0021, Para. 2.3.12.2. (All Failure Causes)
- o TVC system is inspected for external leaks per 10REQ-0021, Para. 2.3.11.3, 2.3.15.5, and 2.2.16.5 respectively following low speed GN2 spin, high speed GN2 spin and post hotfire inspection. (All Failure Causes)
- o 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)
- o Hydraulic circuit fluid leak test is verified per 10REQ-0021, Para. 2.3.3.3 prior to hotfire. (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 per 10REQ-0021, Para. 2.3.16 (including verification of rock and tilt reservoirs between 50 and 90 percent). (All Failure Causes)
- o Prelaunch hydraulic system leak check is witnessed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020.. (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.

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