

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Manual Shut-off Valve
Assembly

PART NO.: 10201-0046-802 FM CODE: A03
10209-0034-801 (Fitting)

Includes:

Rigid Lines

10201-0003-105
10201-0003-108 (Alt)
10201-0003-106
10201-0003-109 (Alt)

Elbow

10209-0067-801
10209-0132-801 (Alt)

Connectors

10209-0028-801
10209-0034-801

Plug Bleeder

MS24391J4L
MS24391S4L (Alt)

O-rings

Type M83248/1

ITEM CODE: 20-01-38

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 4

DATE: March 1, 2001

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 2000

FMEA PAGE NO.: A-128

ANALYST: B. Snook/S. Parvathaneni

SHEET 1 OF 6

APPROVED: S. Parvathaneni

FAILURE MODE AND CAUSES: External leakage of hydraulic fluid (System A and/or B) at manual shut-off valve and at any one of four fitting O-rings or any one of five dynatube seals or any one of four line swages caused by:

- o Valve seat failure
- o Stem failure
- o Improper torque

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- o Contamination
- o - and-
- o Contamination
- o Defective or damaged O-ring
- o Defective or damaged sealing surface
- o Defective line swage
- o Misalignment of dynatube seals
- o Improper torque
- o Improperly lockwired

FAILURE EFFECT SUMMARY: Fire and explosion will lead to loss of mission, vehicle and crew.

REDUNDANCY SCREENS AND MEASUREMENTS:

- 1) Fail - Redundancy is not verified on new or refurbished units.
- 2) Fail - Undetectable loss of redundancy.
- 3) Fail - Contamination

RATIONALE FOR RETENTION:

A. DESIGN

- o The Manual Shutoff Valve Assembly is designed and qualified in accordance with end item specification 10SPC-0081. (All failure causes)
- o Outlet port connector is MS 33649 fluid boss employing an o-ring between the fluid fitting and the boss. (Defective or Damaged O-ring)
- o O-ring material is viton which is compatible with hydraulic fluid. (Defective or Damaged O-ring and Contamination)
- o Dynatube fitting installation is per 10PRC-0038. (Misalignment of Dynatube Seals)
- o Tube and hose assemblies are fabricated per 10PRC-0038. This includes preparation and inspection of tube/hose ends and fittings, assembly alignment checks and acceptance criteria of the assembled unit. (Misalignment of Dynatube Seals, Defective Line Swage, Defective or Damaged Sealing Surface)
- o Fluid connections are lockwired per MS 33540. (Improperly Lockwired)
- o Contamination is controlled by Kaiser Electro Precision Cleaning and Packaging specifications RYY-101-140, and RYY-101-141. (Contamination)
- o Hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to minimize fire hazard. (Contamination)

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- o Fluid procurement is controlled per SE-S-0073. (Contamination)
- o Valve body, sleeve and adaptor are 455 stainless steel. (Stem Failure)
- o Seat material is 455 stainless steel. (Valve Seat Failure)
- o Assembled parts are cleaned per 10PRC-0620. (Contamination)
- o Stem has wrench flats and is capped to prevent inadvertant opening. (Improper Torque)
- 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 Kaiser Qualification Test Report RYY-204-032 Rev. Basic, and supplemental Qualification Test Report RYY-204-036, Rev. Basic. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per Kaiser ATP RYY-104-039 on each new unit. This includes visual examination, proof pressure test to 4875 psig, valve operation tests, and leak tests for five minutes at 3250 psig with leakage insufficient to form a liquid drop. (All Failure Causes)
- o During refurbishment and prior to reuse, Manual Shutoff Valve is reworked per 10SPC-0131 and acceptance tested by USA SRBE/TBE Florida operations per the criteria of 10SPC-0081. This includes visual examination, proof pressure test to 4975 ± 100 psig, valve operation tests and leak test for five minutes at 3300 ± 50 psig with leakage insufficient to form a liquid drop. (All Failure Causes)
- o At installation, the manual shut-off valve fluid connections are leak tested with helium to an acceptable level per 10REQ-0021, para. 2.3.3.3 except the bleeder plug at the service panel. (All Failure Causes)
- o Individual tube assemblies are hydrostatically proof tested per 10REQ-0021, para. 2.3.3.5. (Defective Line Swage)
- o Individual tube assemblies are helium leak tested per 10REQ-0021, para. 2.3.3.6. (Defective Line Swage)
- o Individual tube assemblies are precision cleaned by USA SRBE per 10REQ-0021, para. 2.3.0. (Contamination)
- 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 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 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 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)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- o Vendor acceptance of sealing surfaces and O-rings are verified by USA SRBE PQAR per SIP 1180. (Defective or Damaged Seat, Defective or Damaged O-ring, and Defective or Damaged Sealing Surface)
- o Material certifications is verified by USA SRBE PQAR per SIP 1180. (Defective or Damaged Sealing Surface, Stem Failure and Valve Seat Failure)
- o Penetrant inspections are verified by USA SRBE PQAR per SIP 1180. (Defective or Damaged Sealing Surface and Stem Failure)
- o Verification of sealing surface acceptance is performed by USA SRBE PQAR per SIP 1180. (Defective or Damaged Sealing Surface)
- o Assembly is verified by USA SRBE PQAR per SIP 1180. (Improper Torque)
- o Torque operation is verified by USA SRBE PQAR per SIP 1180. (Improper Torque, Improper Lockwire)
- o Acceptance test is witnessed by USA SRBE PQAR per SIP 1180. (All Failure Causes)
- o Critical Processes/Inspections:
 - Penetrant inspection per MIL-STD-6866

II. KSC RELATED REFURBISHMENT INSPECTION

- o Visual inspection of Manual Shut-off Valve will be performed per 10SPC-0131, para. II. (All Failure Causes)
- o Functional testing of Manual Shut-off Valve 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 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. (K-seal Failure)
- 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 Proper torque is witnessed per 10REQ-0021, para. 2.1.4. (Improper Torque)
- o Proper lockwire is verified per 10REQ-0021, para. 2.1.4. (Improper Lockwired)
- o Hydraulic circuit fluid leak test is verified per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (All Failure Causes)
- o Individual tube assemblies are inspected for the requirements of 10PRC-0038 per 10REQ-0021, para. 2.3.0. (Defective Line Swage)
- o Hydrostatic test is witnessed per 10REQ-0021, para. 2.3.3.5. (Defective Line Swage)
- o Individual tube assemblies helium leak test is performed per 10REQ-0021, para. 2.3.3.6. (Defective Line Swage)
- o Tube assemblies cleanliness is verified by USA SRBE per 10REQ-0021, para. 2.3.0. (Contamination)
- o Torque and lockwiring of the manual valve outlet to service panel tube connections are 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 Verification of no hydraulic bleeder valve (stem/seat) leakage per 10REQ-0021, para. 2.3.10.3. (Stem Failure)
- o Proper torque of the bleeder stem is witnessed per 10REQ-0021, para. 2.1.4 after servicing. (Improper Torque)

- 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 Verification of visual leak check of hydraulic circuit (system) joints is performed per 10REQ-0021, para. 2.3.12.2. (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 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)
- 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 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 Verification of torque and lockwire of bleed stem and bleed plug per 10REQ-0021, para. 2.1.4 and inspection of bleed plug o-ring and bleed plug for damage or contamination prior to installation per 10REQ-0021, para. 2.3.0. and also OMRSD File V, Vol. 1, requirement numbers B42GEN.010 and B42GEN.020. (Improper Torque, Improperly Lockwired, Contamination)
- o Pre-launch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Numbers 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.