

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Quick Disconnect (QD) and Cap Assembly (Hydraulic)

PART NO.: 10201-0055-801 FM CODE: A03
10201-0056-801 (Cap)
M83248/1 (O-ring)

ITEM CODE: 20-01-36 REVISION: Basic

CRITICALITY CATEGORY: 1R REACTION TIME: S econds

NO. REQUIRED: 4 DATE: March 1, 2002

CRITICAL PHASES: Final Countdown, Boost SUPERCEDES: March 1, 2001

FMEA PAGE NO.: A-123 ANALYST: B. Snook/S. Parvathaneni

SHEET 1 OF 5 APPROVED: S. Parvathaneni

FAILURE MODE AND CAUSES: External leakage (leakage of poppet seal and leakage of cap seal) caused by:

- o Poppet spring failure
- o Defective or damaged seat
- o Contamination
- and -
- o Defective or damaged O-ring
- o Improper torque
- o Improperly lockwired
- o Contamination
- o Defective or damaged sealing surfaces

FAILURE EFFECT SUMMARY: Fire and explosion will lead to loss of mission, vehicle and crew. One success path remains after the first failure. Operation is not affected until both paths are lost.

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 Quick Disconnect and Cap Assembly is designed and qualified in accordance with end item specification 10SPC-0057. (All Failure Causes)
- o The quick disconnect cap has an O-ring seal which provides redundancy to the internal poppet seal to protect against external leakage from an internal source. (Defective or Damaged Seat, or Sealing Surfaces,Poppet Spring Failure and Contamination)
- o All threaded fittings and connectors are torqued per engineering specifications and are lockwired per MS 33540. (Improper Torque, Improperly Lockwired)
- o Cap assembly O-ring is made of viton which is compatible with hydraulic fluid. (Contamination and Defective or Damaged O-ring) CN 044
- o Poppet seal material is Teflon. (Defective or Damaged Seat)
- o The poppet is spring loaded to the closed (sealed) position. Spring material is 17-7PH CH900. (Poppet Spring Failure)
- o Contamination is controlled by Kaiser Electro Precision Cleaning and Packaging Specifications RYY-101-140, and RYY-101-141. (Contamination)
- o Assembled parts are cleaned per 10PRC-0620. (Contamination)
- o The hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed specifically to minimize the fire hazard. (Contamination)
- o The aft skirt area is purged with GN₂ prior to APU start up, reducing the O₂ concentration to less than four percent per OMRSD File II, Vol. 1, requirement number S00FMO.430. (All Failure Causes)
- o Qualification testing verified design requirements as reported in Kaiser Electro Precision Qualification Test Report RYY-201-062 Rev. A. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed at vendor's plant per Kaiser Electro Precision ATP RYY-10-1-152. This includes visual examination, Cleanliness Verification, Proof Pressure Test to 4875 psig and fluid leak test for no leakage sufficient to form a liquid drop. (All Failure Causes)
- o During refurbishment and prior to reuse, nippy assembly is processed for rework per 10SPC-0131 and acceptance tested per the criteria of 10SPC-0057 by USA SRBE/TBE Florida Operations. This includes visual examination, cleanliness verification, proof pressure test to 4975 ± 100 psig and fluid leak test for no leakage sufficient to form a liquid drop. (All Failure Causes)

- o During refurbishment and prior to reuse, the cap assembly is reworked per 10SPC-0131 and acceptance tested by USA SRBE/TBE Florida operations per criteria of 10SPC-0057. This includes visual examination, cleanliness verification, proof pressure test to 4975 ± 100 psig for one minute minimum, external leakage test at 3300 ± 50 psig for 5 minutes with no leakage sufficient to form a liquid drop. (All Failure Causes)
- o Hydraulic system leak test with helium to an acceptable level per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)
- o Helium leak test to less than 1×10^{-4} secs is performed 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 reservoir, the rock reservoir and the tilt actuator per 10REQ-0021, para. 2.3.12.3. (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 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)

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 Proper assembly and torque are verified by USA SRBE PQAR per SIP 1180. (Improper Torque and Improperly Lockwired)

- o All material certifications are verified by USA SRBE PQAR per SIP 1180. (Poppet Spring Failure)
- o Cleanliness of components is verified by USA SRBE PQAR per SIP 1180. (Contamination)
- o Final acceptance tests are witnessed by USA SRBE PQAR per SIP 1180. (All Failure Causes)
- o Final inspection and packaging is verified by USA SRBE PQAR per SIP 1180. (All Failure Causes)
- o Critical Processes/Inspections:
 - Heat Treat per RYY-115-022
 - Electropolish spring per RYY-101-204

II. KSC RELATED REFURBISHMENT INSPECTIONS

- o Visual inspection of quick disconnect and cap assembly will be performed per 10SPC-0131, para. II. (All Failure Causes)
- o Functional testing of quick disconnect and cap 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 Helium (inluent) cleanliness and composition is verified 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 The moisture content and cleanliness (water content and particulate count) of the effluent hydraulic fluid from the rock actuator, the tilt reservoir, the rock reservoir and the tilt actuator are verified per 10REQ-0021, para. 2.3.12.3. (Contamination)
- 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: (All Failure Causes)
 - Low Speed GN2 spin
 - High Speed GN2 spin
 - Hotfire (Includes verification of Rock and Tilt reservoirs to 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 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. I, Requirement Number B42HPO.010.(Contamination)
- o Torque and lockwiring verified by SPC per OMRSD File V, Vol. I, requirement numbers B42GEN.010 and B42GEN.020. (Improper torque, Improper lockwiring)
- o Hydraulic System leak test is performed and verified per OMRSD File V, Vol. I, requirement number B42HP0.020. (All Failure Causes)
- o TVC Couplings (Both SRB and GSE) are inspected each time prior to mating per 10REQ-0021 para. 2.3. After transfer to SPC they are inspected prior to mating per File V, Vol. I, requirement number B42GEN.070. (Defective or damaged sealing surface, contamination)

D FAILURE HISTORY

- o Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- o Not applicable to this failure mode.