

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : FWD - REACTION CONTROL FMEA NO 03-2F -101091-1 REV:04/09 88

ASSEMBLY : PRESSURIZATION CRIT. FUNC: 1R
P/N RI : ME276-0032-0019/-0021 CRIT. HDW: 3
P/N VENDOR: R642900-143 VEHICLE 102 103 104
QUANTITY : 12 EFFECTIVITY: X X X
: 6 PER PROPELLANT PHASE(S): PL X LO X OO X DO X LS X

*REDUNDANCY SCREEN: A-FAIL B-FAIL C-PAE

PREPARED BY: DES J LAZARUS APPROVED BY: *[Signature]* APPROVED BY (NASA):
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ITEM:
DISCONNECT, QUICK, TEST POINT HELIUM. (MD 101, 102, 103, 104, 107, 108, 109, 110, 111, 112, 113, 114)

FUNCTION:
TO PROVIDE ACCESS TO THE HELIUM SUPPLY SYSTEM FOR CHECKOUT OF THE HELIUM ISOLATION VALVES AND REGULATORS. COMPONENTS ARE ACCESSIBLE ONLY WITH THE MODULE OFF THE VEHICLE. END CAP PROVIDES REDUNDANCY FOR EXTERNAL LEAKAGE.

FAILURE MODE:
EXTERNAL LEAKAGE, POPPET FAILS OPEN, AND CAP LEAKS.

CAUSE(S):
SEALS DAMAGED OR DETERIORATED, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, IMPROPER USE, INADEQUATE MAINTENANCE OF GSE HALF, INADEQUATE LINE SUPPORT, SHAFT OR BORE BENT, OVERPRESSURE OF PANEL, EXCESS TORQUE.

EFFECT(S) ON:
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
(A) LOSS OF HELIUM PRESSURANT AND REDUNDANCY. (THIRD ORDER FAILURE).
(B) NO EFFECT
(C) NO EFFECT
(D) NO EFFECT
(E) FUNCTIONAL CRITICALITY EFFECTS - POTENTIAL CREW/VEHICLE LOSS IF PROPELLANT CAN NOT BE UTILIZED OR DEPLETED DUE TO INABILITY TO REPRESSURIZE PROP TANKS AS A RESULT OF HELIUM LOSS PRIOR TO ET SEP. POSSIBLE DAMAGE TO POD STRUCTURE AND ADJACENT HARDWARE IF CAP BLOWS OFF 1R EFFECT ASSUMES LOSS OF ALL SEALS (POPPET AND CAP) BEFORE EFFECT IS MANIFESTED. CANNOT CHECK REDUNDANT SEALS WHEN CAP IS INSTALLED. REQUIRES ALL SEALS TO LEAK ON ORBIT BEFORE FAILURE IS DETECTABLE.

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DISPOSITION & RATIONALE:

(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

(A) DESIGN

DUAL SEAL SURFACES WHEN CAP INSTALLED PRECLUDES FAILURE (EACH SEALING SURFACE INDEPENDENT OF THE OTHER). THE DESIGN BURST PRESSURE IS 2X THE MAX OPERATING PRESSURE (10,000 PSI). A COMPLETE STRESS ANALYSIS WAS PERFORMED.

THE GSE HALF HAS A 10 MICRON FILTER TO PREVENT CONTAMINATION.

(B) TEST

THE QUALIFICATION TEST PROGRAM INCLUDED NINE UNITS. HOWEVER, ALL TESTS WERE NOT PERFORMED ON ALL UNITS. THE TESTING INCLUDED RANDOM VIBRATION (POPPET OPEN AND CAP ON), ENDURANCE (400 CYCLES), THERMAL: +150 DEGREES F (-100 DEGREES F CERTIFIED BY MPS), AND BURST (10,000 PSI).

THE UNIT WAS ALSO QUALIFIED AS PART OF THE POD ASSEMBLY IN THE VIBRO-ACOUSTIC TESTING AT JSC (131 EQUIVALENT MISSIONS) AND THE HOT FIRE TEST PROGRAM AT WSTF (24 EQUIVALENT MISSION DUTY CYCLES AND APPROX 7 YEARS OF PROPELLANT EXPOSURE).

THE ACCEPTANCE TESTING INCLUDES PROOF OF EACH UNIT (1.5 X THE MAX OPERATING PRESSURE 7500 PSI), FUNCTIONAL TESTS, CLEANLINESS, AND TESTING OF THE CAP AS AN ASSEMBLY. THE UNIT IS LEAKED CHECKED WITH AND WITHOUT A CAP INSTALLED.

OMRSD PERFORMS THE FOLLOWING: A DECAY CHECK OF THE LOW PRESSURE HELIUM SYSTEM EVERY FLIGHT. AN EXTERNAL LEAKAGE VERIFICATION OF THE SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS THEREAFTER. A TEST POINT COUPLING LEAK CHECK EVERY FIVE FLIGHTS AND WHENEVER THE COUPLING IS USED. AN INSPECTION OF THE CAP SEALS THE FIRST FLIGHT AND WHENEVER THE QD IS USED DURING TURNAROUND. HELIUM SYSTEM SAMPLE TEST EVERY THIRD MISSION AND ON A CONTINGENCY BASIS. CANNOT CHECK REDUNDANT SEALS WHEN CAP IS ASSEMBLED. LOADED PROPELLANTS MEET REQUIREMENT SE-S-0073.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL IS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS LEVEL OF 100 FOR MMH AND 100A FOR N2O4 IS VERIFIED BY INSPECTION. CORROSION PROTECTION IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

LIP SEALS ARE VISUALLY INSPECTED UNDER 14X TO 30X MAGNIFICATION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES

WELDING IS VERIFIED BY INSPECTION.

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TESTING

ENGAGING TORQUE IS VERIFIED BY INSPECTION. SEALING SURFACES ARE VISUALLY INSPECTED PRIOR TO ENGAGEMENT WITH MATING HALF. ATP IS WITNESSED AND VERIFIED BY INSPECTION. SAMPLE WELDS ARE SECTIONED AND CHECKED FOR WELD PENETRATION ON A PLAN OF 1 SAMPLE PER 20 WELDS.

HANDLING/PACKAGING

PACKAGING, HANDLING, AND STORAGE ENVIRONMENT PROCEDURES ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

CARS A10762 (WSTF), AD0162 (KSC), AC0519 (SUP), AC8608 (SUP): SEVERAL CONTAMINATION INDUCED LEAKAGE FAILURES HAVE OCCURRED. LEAKAGE WAS RELATIVELY MINOR. OMRSD SCREENS FOR LEAKAGE AFTER EACH USAGE AND PRIOR TO INSTALLATION OF CAP.

CAR AC9143:

FOUR HIGH PRESSURE QD'S WERE REMOVED FROM OV102 BECAUSE OF LEAKAGE. ANALYSIS IDENTIFIED THE CAUSE TO BE DUE TO DISTORTED SEALS (CAR STILL OPEN, POSSIBLE KYNAR SEAL MMH COMPATIBILITY PROBLEM) CORRECTIVE ACTION CONCERNING THE POSSIBLE MATERIAL (KYNAR) INCOMPATIBILITY IS PENDING COMPLETION OF THE FAILURE ANALYSIS. ALL HIGH PRESSURE QD'S WILL BE VERIFIED TO BE NOT LEAKING BEFORE FLIGHT STS-26.

CAR AC9986:

THREE QD'S WERE REMOVED FROM OV102 BECAUSE OF LEAKAGE. ONE COUPLING LEAK WAS DUE TO METALLIC CONTAMINATION, MOST PROBABLY CAUSED BY USE OF FREON IN CLEANING PROCEDURES. ONE LEAKED BECAUSE OF A LARGE PIECE OF ALUMINUM TAPE AND THE OTHER LEAKED BECAUSE OF SMALL METALLIC PARTICLES EMBEDDED IN THE POPPET SEAL. CORRECTIVE ACTION FOR CONTAMINATION CONTROL WAS IMPLEMENTED AT KSC BY ADHERING TO THE OMRSD PARAGRAPHS SPECIFICALLY: DETAILED TO PREVENT METALLIC NITRATE AND PARTICLE CONTAMINATION. ONLY IPA IS USED IN CLEANING MMH COMPONENTS.

CAR 5360 (DOWNEY):

AFTER 375 ENDURANCE CYCLES LEAKAGE WAS EXCESSIVE. THE CAUSE WAS CONTAMINANT EMBEDDED IN THE POPPET SEAL. IT WAS CONCLUDED THAT THE PARTICLES WERE INTRODUCED WHILE, OR PRIOR TO, BEING INSTALLED IN THE TEST SET-UP. THERE WAS NO VISIBLE THREAD DAMAGE. CORRECTIVE ACTION - PROCEDURES FOR CONNECTING, DISCONNECTING, AND MAINTAINING CLEANLINESS; I.E. PURGING, DRYING, FILTER INSTALLATION, ENGAGEMENT/DISENGAGEMENT PROCEDURES, CLEANING AND LUBRICATION OF THREADS ARE TO BE IN ACCORDANCE WITH SPECIFICATION MLO310-032 TO PRECLUDE CONTAMINATION.

(E) OPERATIONAL USE

REQUIRES MULTI SEAL FAILURE BEFORE ACTION IS REQUIRED. CLOSE THE HELIUM ISOLATION VALVE AND PERFORM STAGE PRESSURIZATION OF THE PROPELLANT SYSTEM.