

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : FWD - REACTION CONTROL FMEA NO 03-2F -101070-1 REV:04/09/88

ASSEMBLY : PRESSURIZATION
P/N RI : MC276-0017-0402/-0403/-1412/-1413
P/N VENDOR: 75372000-0402/-0403 VEHICLE
QUANTITY : 2 EFFECTIVITY: 102 103 104
: ONE REQ'D FOR EACH PHASE(S): PL X LO X OO X DO X LS X
: PROPELLANT

PREPARED BY: DES J LAZARUS
REL R P DIEHL
QE W J SMITH
REDUNDANCY SCREEN: A-FAIL B-FAIL C-PASS
APPROVED BY: DES [Signature] APPROVED BY (NASA):
REL [Signature] SSM [Signature]
QE [Signature] RED [Signature]
[Signature] 25.6.88 5-13-88 QE [Signature]

ITEM:
DISCONNECT, QUICK, FILL, HE (MD105/106) (1/4") WITH SPRING LOADED POPPET AND STRUCTURAL END CAP.

FUNCTION:
PROVIDE HELIUM TANK FILL AND VENT POINT FOR GROUND SERVICING OPERATIONS AND LOADING. COUPLING IS ACCESSIBLE AT THE HELIUM SERVICING PANEL.

FAILURE MODE:
EXTERNAL LEAKAGE. POPPET FAILS OPEN, CAP LEAKS IN EXCESS OF ACCEPTABLE RATE.

CAUSE(S):
SEALS DAMAGED OR DETERIORATED, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, OR 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 REDUNDANT SEAL, LOSS OF SUB-SYSTEM PRESSURIZATION.
(B) NO EFFECT
(C) NO EFFECT
(D) NO EFFECT
(E) FUNCTIONAL CRITICALITY EFFECT - 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 TPS IF CAP BLOWS OFF. 1R EFFECT ASSUMES LOSS OF SEALS (POPPET AND CAP) AND ULLAGE. CANNOT CHECK REDUNDANT SEALS WHEN CAP IS INSTALLED. REQUIRES BOTH 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

THE DESIGN SAFETY FACTORS ARE 1.5 FOR PROOF PRESSURE (DEMONSTRATED FOR EACH UNIT) AND 2.0 FOR BURST PRESSURE (BY ANALYSIS AND QUAL TEST). A COMPLETE STRESS ANALYSIS WAS PERFORMED. GROUND HALF COUPLINGS AND LINE ARE SUPPORTED TO LIMIT ANY IN-SERVICE STRESS ON THE COUPLING DURING SERVICE. PREVENT DAMAGE TO SEALS AND WELD JOINTS. USE OF A CAP MINIMIZES THE LEAKAGE POTENTIAL BY PROVIDING A REDUNDANT SEAL. THE DESIGN ALLOWS THE REPLACEMENT OF THE POPPET SEAL DURING MAINTENANCE PROCEDURES.

A 10 MICRON FILTER IS INSTALLED IN THE GSE TO PREVENT FAILURES DUE TO CONTAMINATION.

(B) TEST

THREE UNITS WERE USED IN THE QUALIFICATION TEST PROGRAM. THE TESTING INCLUDED RANDOM VIBRATION (48 MINUTES IN EACH AXIS), BASIC AND BENCH ENDURANCE (600 FUNCTIONAL CYCLES : 800 PRESSURE CYCLES), BENDING AND AXIAL LOADS (50 FT-LB, 50 LBS), BURST TEST (10,000 PSI).

THE UNIT ALSO QUALIFIED AS PART OF THE POD ASSY IN THE VIBRO-ACOUSTIC TEST AT JSC. THE HOT FIRE TESTING AT WSTF SUBJECTED THE UNIT TO 24 EQUIVALENT MISSION DUTY CYCLES AND APPROX 7 YEARS PROPELLANT EXPOSURE.

THE ACCEPTANCE TEST INCLUDES PROOF PRESSURE, FUNCTIONAL TESTS, EXTERNAL LEAKAGE TESTS CONDUCTED BEFORE AND AFTER OPERATING CYCLES, AND CLEANLINESS AND DRYING. THE CAP IS TESTED AS AN ASSEMBLY. DURING GROUND TURNAROUND REDUNDANT SEALS CANNOT BE CHECKED WITH CAP INSTALLED.

OMRSD PERFORMS THE FOLLOWING: LEAK CHECKS ON THE HIGH PRESSURE QD COUPLING EVERY FIVE MISSIONS AND WHENEVER THE COUPLING IS USED. PRESSURE DECAY CHECKS ON THE HIGH PRESSURE HELIUM SYSTEM FOR EACH FLIGHT. HELIUM SYSTEM ACTIVATION FOR EACH FLIGHT. HELIUM SERVICING TO FLIGHT LOAD FOR EACH FLIGHT. A LEAK CHECK OF HE CAP SEAL FOR THE FIRST FLIGHT AND WHENEVER THE COUPLING IS USED DURING TURNAROUND (EACH FLIGHT). PERFORMS AN EXTERNAL LEAKAGE VERIFICATION OF THE SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS THEREAFTER. HELIUM SYSTEM SAMPLING EVERY THREE FLIGHTS AND ON A CONTINGENCY BASIS. CANNOT CHECK REDUNDANT SEALS WHEN CAP IS INSTALLED.

(C) INSPECTION

RECEIVING INSPECTION

TEST REPORTS AND MATERIAL CERTIFICATIONS CERTIFYING MATERIALS AND PHYSICAL PROPERTIES ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS LEVEL OF 100A IS VERIFIED BY INSPECTION. CORROSION PROTECTION IS VERIFIED BY INSPECTION.

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ASSEMBLY/INSTALLATION

DISCONNECT IS VISUALLY INSPECTED FOR SURFACE DEFECTS. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. MANUFACTURING PROCESSES, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. SEALS ARE INSPECTED PER SNP 915. INSPECTION VERIFIES BRAYCOTE IS APPLIED TO THREADS, SEALS, AND SLIDING SURFACES.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION OF BODY ASSEMBLY TIG WELD AND FLANGE CASTING PER MIL-I-6866 TYPE I METHOD B IS VERIFIED BY INSPECTION. RADIOGRAPHIC INSPECTION OF THE FLANGE CASTING PER MIL-C-6021, CLASS 1A, GRADE C, IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

THE TIG WELD OF THE BODY ASSEMBLY PER MIL-W-8611 AND THE RESISTANCE WELD OF THE A.H.C. FILTER ASSEMBLY ARE VERIFIED BY INSPECTION.

TESTING

ATP PER ATP75372002 IS WITNESSED AND VERIFIED BY INSPECTION. TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING

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

(D) FAILURE HISTORY

CAR AB3799:

(QUAL) ONE UNIT BECAME DISENGAGED FROM THE CAP DUE TO UNDERSIZED LATCHING GROOVE THAT ESCAPED QUAL MR ACTION. CORRECTIVE ACTION WAS TO MAKE THE SUPPLIER QUALITY PERSONNEL AWARE OF THIS PROBLEM, AND THE SUPPLIER REP. INSPECTED ALL OV102 UNITS AND VERIFIED PROPER ENGAGEMENTS ALL OTHER UNITS VERIFIED IN LINE.

CAR AB4431:

(QUAL) LEAKAGE OF A COUPLING AND CAP OCCURRED BECAUSE OF PARTICLES OF TEFLON CONTAMINATION. TEFLON ORIGINATED FROM GROUND HALF COUPLING. CORRECTIVE ACTION - NO CORRECTIVE ACTION WAS TAKEN AT THE SUPPLIER. DURING SERVICING LEAKAGE IS CHECKED BEFORE AND AFTER CONNECTING GROUND HALF.

CAR AB4181: (QUAL)

LEAKAGE OF A COUPLING AND CAP OCCURRED BECAUSE OF INCORRECT INSTALLATION OF AN OMNI SEAL. CORRECTIVE ACTION REVISED PLANNING AND ADDED AN INSPECTION CHECK.

CAR AB7143: (ATP)

COUPLING LEAKAGE OCCURRED DUE TO PITTED SURFACE. CORRECTIVE ACTION INCORPORATED INSPECTION CHECK WITH 10X MAGNIFICATION VIEWER AND ASSEMBLY CONTAMINATION CONTROL PROCEDURES WERE INSTITUTED.

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CAR A9508: (ATP)
CAP LOCKING FINGERS DID NOT RELOCATE BECAUSE OF AN UNDERSIZED RETAINING RING. CAP BLEED SCREW LEAK OCCURRED BECAUSE OF CONTAMINATION. CAP MALFUNCTION OCCURRED BECAUSE OF IMPROPER SPRING INSTALLATION. CORRECTIVE ACTION WAS TO CHECK ALL RINGS IN STORES. ASSEMBLY PERSONNEL WERE CAUTIONED.

CAR AB5018: (KSC) CAP MALFUNCTION OCCURRED BECAUSE OF IMPROPER SPRING INSTALLATION. CORRECTIVE ACTION - REDESIGN MCR 6284R1. ALL CAPS HAVE BEEN RETROFITTED WITH THE REDESIGN.

CAR AB9513:
A SEAL LEAKAGE FAILURE AT KSC WAS CAUSED BY CONTAMINATION. CORRECTIVE ACTION - ASSEMBLY CONTAMINATION CONTROL PROCEDURES WERE INSTITUTED INCLUDING SEQUENCED ASSEMBLY, WELD SEQUENCES, FLUSH AT HIGHEST LINE ASSEMBLY LEVEL (REF EO 11 TO DWG NO.73A6200060). OMI V1061 WAS REVISED TO REQUIRE INSPECTION PRIOR TO COUPLING.

(E) OPERATIONAL USE

REQUIRES DUAL SEAL FAILURE BEFORE ACTION IS REQUIRED. IF FAILURES OCCUR PRIOR TO ET-SEP, BLOWDOWN IS AVAILABLE FOR NOMINAL ET-SEP IF NO MAJOR DISPERSIONS OCCUR.