

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ORBITAL MANEUVER FMEA NO 03-3 -1003 -2 REV: 3/30/88

ASSEMBLY : PRESSURIZATION SUBSYSTEM

P/N RI : MC621-0059

P/N VENDOR: 73P620001-1001

QUANTITY : 4

: TWO PER POD

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X
PHASE(S):	PL	LO X OO X DO X LS	

CRIT. FUNC: 1R

CRIT. HDW: 2

PREPARED BY:

DES D W CARLSON
REL C M AKERS
QE W J SMITH

REDUNDANCY SCREEN: A-PASS B-PASS C-PASS

APPROVED BY:

DES *[Signature]* APPROVED BY (NASA):
REL *[Signature]* SSM *[Signature]*
QE *[Signature]* REL *[Signature]* 8-26-88

ITEM:

VALVE, HELIUM ISOLATION, SOLENOID, NORMALLY CLOSED, SPRING LOADED (LV401, 402, 501, 502).

FUNCTION:

PARALLEL REDUNDANT VALVES ARE PROVIDED. THEY PREVENT REGULATOR LEAKAGE AND PROPELLANT TANK OVERPRESSURIZATION. GPC POSITION ALLOWS VALVE TO OPEN ON COMMAND FROM THE GPC. OFF-POSITION DURING NON-FIRING PERIODS PREVENTS OPEN BY SPURIOUS SIGNAL. MANUAL ON/OFF-POSITION FOR LAUNCH PRESSURIZATION & ON-ORBIT OMS TO RCS FEED.

FAILURE MODE:

FAILS CLOSED, FAILS TO OPEN, FAILS TO REMAIN OPEN, RESTRICTED FLOW.

CAUSE(S):

ELECTRICAL FAILURE-COIL SHORT, (BELLOWS LEAK, PROPELLANT VAPOR EXPOSURE), JAMMING OF POPPET, SPRING, PLUGGED PILOT ORIFICE, PLUGGED INLET FILTER, SHOCK, VIBRATION, CONTAMINATION.

EFFECT(S) ON:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A, B) LOSS OF REDUNDANCY (ONE OF 2 FLOW PATHS).

(C) NO EFFECT.

(D) NO EFFECT UNLESS MULTIPLE FAILURES OCCUR.

(E) FUNCTIONAL CRITICALITY EFFECT - POSSIBLE CREW VEHICLE LOSS. FAILED CLOSED OF REDUNDANT PARALLEL FLOW PATHS RESULTS IN INABILITY TO UTILIZE/DEplete PROPELLANT WITH RESULTANT INABILITY TO DEORBIT OR MAINTAIN SAFE C.G. FOR VEHICLE. REDUNDANCY B & C SCREENS ARE PASS; VALVES ARE USED INDIVIDUALLY DURING PAD PRE-PRESS AND FOR ON-ORBIT

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BURNS. CONTAMINATION THAT WOULD CAUSE BOTH VALVES TO BE RESTRICTED IS NOT CREDIBLE.

DISPOSITION & RATIONALE:

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

(A) DESIGN

PARALLEL FLOW PATHS ARE PROVIDED. ULLAGE PRESSURE IS ADEQUATE FOR PROPELLANT FEED WITH LESS THAN 40% PROPELLANT REMAINING. A 50-MICRON FILTER IS PROVIDED ON THE INLET AND A 70 - MICRON FILTER ON THE OUTLET TO LIMIT THE POSSIBILITY OF CONTAMINATION CAUSING LEAKAGE, JAMMING MOVING PARTS OR PLUGGING PILOT CONTROL ORIFICES. THE LEAD AND MAGNET WIRES ARE ENCAPSULATED BY POTTING AND A FIXTURE IS USED DURING ASSEMBLY TO ENSURE THAT INSULATION IS NOT DAMAGED BY THE EXIT NOTCH WHEN THE COIL SLEEVE IS PRESSED ONTO THE COIL.

(B) TEST

QUALIFICATION TESTS

(3 UNITS) - RANDOM VIBRATION - 48 MINUTES EACH AXIS (100 MISSION EQUIV LENT). SHOCK-BENCH AND OPERATIONAL USE. THERMAL- (+210 TO -30 DEGREES F.). ENDURANCE - 480 OPERATIONAL CYCLES (ON-OFF- FLOW). BURST TEST - 10000 PSI. ALSO QUALIFIED AS PART OF POD ASSEMBLY - VIBRO-ACOUSTIC TESTING AT JSC (131 EQUIVALENT MISSIONS). HOT-FIRE TEST PROGRAM AT WSTF (24 EQUIVALENT MISSIONS).

ACCEPTANCE TEST

EACH UNIT - PROOF PRESSURE, FUNCTIONAL TESTS, INTERNAL LEAKAGE TESTS PERFORMED BEFORE AND AFTER OPERATING CYCLES.

GROUND TURNAROUND

OPERATION OF THE HELIUM ISOLATION VALVE IS VERIFIED AS PART OF THE REGULATION FLOW TEST CONDUCTED PER V43CBO.030/V43CBO.040. V43CAO.040 PERFORMS SOLENOID ISOLATION VALVE ELECTRICAL VERIFICATION FOR THE FIRST FLIGHT. V43CAO.072 PERFORMS REDUNDANT CIRCUIT VERIFICATION FOR THE ORBITER/POD EVERY FLIGHT. V43CAO.075 PERFORMS ELECTRICAL INTERFACE VERIFICATION FOR THE ORBITER/POD ON A CONTINGENCY BASIS. V43CFO.025 PERFORMS HELIUM ACTIVATION EVERY FLIGHT. VALVES ARE USED INDIVIDUALLY DURING PAD PRE-PRESS AND FOR ON-ORBIT BURNS AND INTERCONNECT. SYSTEMS FLUIDS ARE ANALYZED FOR COMPLIANCE TO SPECIFICATION REQUIREMENTS AND TO VERIFY THAT ANY CONTAMINATION IS WITHIN PRESCRIBED LIMITS.

(C) INSPECTION

RECEIVING INSPECTION

MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS OF COMPONENTS TO LEVEL 100A PRIOR TO ASSEMBLY, CLEANLINESS OF ASSEMBLY TO LEVEL 100A AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION.

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ASSEMBLY/INSTALLATION

MANUFACTURING, ASSEMBLY AND INSTALLATION PROCEDURES ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. DIMENSIONAL AND VISUAL INSPECTION OF ELECTRICAL COMPONENTS IS PERFORMED AT THE LOWEST LEVEL OF ASSEMBLY. VISUAL AND DIMENSIONAL INSPECTION OF COMPONENTS (INCLUDING SEALS FOR DAMAGE) IS PERFORMED DURING FABRICATION. INSPECTION ALSO VERIFIES THAT SEALS ARE NOT DAMAGED DURING ASSEMBLY.

CRITICAL PROCESSES

THE WELDING PROCESS AND VERIFICATION THAT WELDS MEET SPECIFICATION REQUIREMENTS ARE VERIFIED BY INSPECTION

NONDESTRUCTIVE EVALUATION

PENETRANT AND RADIOGRAPHIC INSPECTION OF WELDS ARE VERIFIED BY INSPECTION.

TESTING

TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. FUNCTIONAL TEST OF ELECTRICAL COMPONENTS IS VERIFIED BY INSPECTION. ACCEPTANCE TEST IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE AND SHIPPING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

NO FAILED CLOSED CONDITION OF THE CURRENT VALVE DESIGN HAS BEEN VERIFIED. HOWEVER, KSC DID REPORT FAILURE OF A VALVE TO OPEN AFTER BEING POWERED OPEN FOR AN EXTENDED TIME PERIOD. THIS FAILURE COULD NOT BE REPEATED AND THE CAUSE WAS NOT DETERMINED.

CAR'S AC4381 AND A7239 INSTANCES OF HIGH PULL IN VOLTAGE. THESE WERE DUE TO THE POPPET SPRING DRAGGING ON THE POPPET SHAFT AND EXCESSIVE ARMATURE AND POPPET STROKE REQUIREMENTS. THESE ITEMS WERE CORRECTED BY CHANGE IN DESIGN TOLERANCES, POPPET STROKE AND PILOT POPPET PRE-TRAVEL REQUIREMENTS, AND ADDITIONAL INSPECTION.

ELECTRICAL SHORT CONDITIONS THAT INITIALLY RESULT IN A FAILED OPEN CONDITION COULD SUBSEQUENTLY RESULT IN AN ELECTRICAL OPEN CONDITION THAT WOULD CAUSE THE VALVE TO REMAIN CLOSED. REFERENCE CAR A7909 (CONDITION CORRECTED BY DESIGN AND PROCESS CHANGES).

(E) OPERATIONAL USE

CONTINUE MISSION USING PARALLEL FLOW PATH. ULLAGE BLOWDOWN ADEQUATE FOR DEORBIT AFTER OMS-2 FOR TYPICAL MISSIONS (APPROX 60 PERCENT ULLAGE REQUIRED FOR MAX BLOWDOWN). TYPICAL DEORBIT BURN REQUIRES LESS THAN 30 PERCENT PROPELLANT.