SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ORBITAL MANEUVER FMEA NO 03-3 -1009 -5 REV: 3/30/88

ASSEMBLY :PRESSURIZATION SUBSYSTEM
P/N RI :MC284-0421-0015, -0016
P/N VENDOR:
QUANTITY :4
:TWO PER POD
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102	103	104
	X	X	X

PHASE(S): PL X LO X OO X DO X LS X

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

PREPARED BY:		APPROVED BY:	APPROVED BY (NASA):
DES	D W CARLSON	DES	SSM
REL	C M AKERS	REL	REL
QE	W J SMITH	QE	QE

ITEM:
VALVE, RELIEF, PRESSURE, BURST DISC & POPPET.

FUNCTION:
PROVIDES PRESSURE RELIEF IN EVENT REGULATOR FAILS OPEN OR PROPELLANT PRESSURE RISES DUE TO THERMAL INCREASE. THE S.S. BURST DISC RELIEF PRESSURE IS 303 TO 313 PSI. THE BURST DISC PROTECTS THE RELIEF VALVE FROM PROPELLANT EXPOSURE. THE BURST DISC ACTUATION IS CONTROLLED BY INLET PRESSURE ACTING ON A BELLEVILLE SPRING MECHANISM. THE MAIN POPPET CRACKING PRESSURE IS 286 PSI AND THE MINIMUM RESEAT PRESSURE IS 280 PSI. AMBIENT PRESSURE SENSING (EXTERNAL) IS PROVIDED.

FAILURE MODE:
EXTERNAL LEAK, FAILS OPEN, MAIN POPPET DOES NOT RESEAT AS REQUIRED.

CAUSE(S):
CORROSION, CONTAMINATION, POPPET BINDS IN GUIDE, SPRING BREAKS OR COCKS, SEAT CRACKS, MOISTURE FREEZES, VIBRATION, SHOCK.

EFFECT(S) ON:
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE

(A) LOSS OF REDUNDANCY FOR OVERBOARD PRESSURANT LEAKAGE.

(B,C,D,) NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECT - POTENTIAL LOSS OF CREW/VEHICLE. LOSS OF PRESSURANT RESULTS IN INABILITY TO UTILIZE/DEPLETE PROPELLANT REQUIRED FOR DEORBIT OR MAY CAUSE ENTRY PROBLEMS DUE TO ADVERSE C.G. OF UNUSED PROPELLANT WEIGHT. POTENTIAL PROPELLANT TANK STRUCTURAL FAILURE AT LANDING DUE TO EXCESSIVE PROPELLANT REMAINING. (1R EFFECT REQUIRES FAIL OPEN CONDITION FOR BOTH THE BURST DISC AND THE MAIN POPPET.)

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DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A) DESIGN
THE BURST DISC IS REDUNDANT TO THE MAIN POPPET FOR THE EXTERNAL LEAKAGE MODE (MAIN POPPET LEAKAGE WOULD NOT BE SENSED UNTIL AFTER BURST DISC ACTUATION OR FAILURE.) A 25-MICRON FILTER DOWNSTREAM OF THE BURST DISC WILL REDUCE THE POTENTIAL FOR CONTAMINATION CAUSED LEAKAGE FAILURE. THE HELIUM ISOLATION VALVE IS CLOSED DURING STATIC PERIODS. THIS WOULD PREVENT CONTINUING LOSS OF SOURCE PRESSURE. THE MAIN POPPET STEM IS A SEPARATE PIECE FROM THE MAIN SENSING SPRING ACTUATION MECHANISM. THIS PROVIDES CLOSE TOLERANCE CONTROL OF OPENING PRESSURE & ALLOWS THE POPPET TO SEAT INDEPENDENTLY OF THE LARGE SENSOR SPRING FORCE. ON ORBIT BURNS UTILIZE A SINGLE REGULATOR LEG (MINIMIZES POTENTIAL FOR OVERSHOOT). DEORBIT BURN PROCEDURE (DUAL REG OPERATION) OPENS ONE REGULATOR AT A TIME. OMS-1 BURN AND ABORT DUMPS UTILIZE SIMULTANEOUS REGULATOR OPENING.

(B) TEST

QUALIFICATION TEST
QUALIFICATION TEST (FOUR UNITS). RANDOM VIBRATION, SHOCK - MIL-STD-810, 20 G PEAK, THERMAL CYCLE (- 20 TO 150 DEGREES F). ENDURANCE - 260 CYCLES (RELIEF VALVE), 36,500 CYCLES (BURST DISC), PROPELLANT COMPATIBILITY. ALSO QUALIFIED AS PART OF POD ASSEMBLY. VIBRO-ACOUSTIC TESTING AT JSC - 131 EQUIVALENT MISSIONS. HOT-FIRE TEST PROGRAM AT WSTF-517 TESTS (24 EQUIVALENT MISSION DUTY CYCLES). APPROXIMATELY 7 YEARS PROPELLANT EXPOSURE.

ACCEPTANCE TEST
PROOF PRESSURE, EXTERNAL LEAKAGE, INTERNAL LEAKAGE, CRACK AND RESEAT, FLOW CAPACITY, CLEANLINESS AND DRYING.

GROUND TURNAROUND
V43CB0.090 PERFORMS BURST DISC LEAK CHECK EVERY FLIGHT.
V43CB0.100 REQUIRES CRACK, RESEAT AND LEAKAGE TESTS EVERY 5TH FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION
MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL 100A FOR RELIEF VALVE INTERNAL FLOW CAVITY AND LEVEL V.C. FOR EXTERNAL SURFACES AND OTHER INTERNAL PARTS IS VERIFIED BY INSPECTION. CORROSION PROTECTION (PASSIVATION AND ECONOCHROME) IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MANUFACTURING ASSEMBLY AND INSTALLATION PROCEDURES ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. SEAT INSPECTION FOR SURFACE DEFECTS IS VERIFIED BY INSPECTION. TEFLON GUIDE RINGS INSTALLATION AND VERIFICATION OF NO GUIDE STEM BINDING ARE VERIFIED BY INSPECTION.

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NONDESTRUCTIVE EVALUATION
RADIOGRAPHIC INSPECTION OF WELD #W8 (PER EPS5760009) PER MIL-STD-453 IS VERIFIED BY INSPECTION. PENETRANT INSPECTION PER MIL-I-6866 (TYPE I METHOD A OR C), OF WELDS #'S W3, W5, W8, W9 AND W11 IS VERIFIED BY INSPECTION.

CRITICAL PROCESS
THE WELD PROCESS PER EPS5760009 IS VERIFIED BY INSPECTION. VISUAL OR 10X MAGNIFICATION INSPECTION OF ALL WELDS IS VERIFIED BY INSPECTION. PROOF PRESSURE TEST AND LEAK TEST OF CERTAIN WELDS IS VERIFIED BY INSPECTION.

TESTING
TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. PROOF PRESSURE TEST OF WELDED JOINTS IS VERIFIED BY INSPECTION. ACCEPTANCE TEST INCLUDING CLEANLINESS TEST, INTERNAL LEAKAGE TEST TO VERIFY SEAT INTEGRITY, PROPER POPPET OPERATION, PROPER SET POINT OPERATION OF BELLEVILLE WASHER SPRING AND PRESSURE SETTING IS VERIFIED BY INSPECTION.

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

(D) FAILURE HISTORY
NO FLIGHT FAILURE HISTORY.

CAR'S AC0826 AND AB5024 RECORD RESEAT PRESSURE PROBLEMS WERE ASSOCIATED WITH AN OLDER DESIGN CONFIGURATION.

CAR AB3925 AND AB4118 RECORD LOW RESEAT PRESSURE DUE TO LACK OF LUBRICANT ON DIAPHRAGM ASSEMBLY AND GUIDE. UNITS WERE RETURNED FOR DISASSEMBLY, REBUILD AND LUBRICANT PER DRAWING REQUIREMENTS. THE SUPPLIER AMR 5762052 WAS REVISED ACCORDINGLY. THE UNITS WERE IDENTIFIED WITH NEW PART NUMBERS.

CAR AB8367 AND AB8518 IDENTIFIED LOW RESEAT PRESSURE DURING DELTA QUAL TEST DUE TO INTERNALLY GENERATED CONTAMINATION AND THAT INDUCED FROM THE TEST SET UP. THE UNITS HAD BEEN USED IN THE PRIOR QUAL TEST AND THE MAIN POPPET STEM AND GUIDE HAD NOT BEEN REPLACED. THE TEST STAND WAS CLEANED, ADDITIONAL FILTERS INSTALLED AND THE UNIT REBUILT PRIOR TO TEST RESTART.

CAR AC3009 RECORDS LOW RESEAT PRESSURE DURING ATP DUE TO SEAT DAMAGE FROM CONTAMINATION. THE SUPPLIER AMR 5802014 WAS REVISED TO REQUIRE THE USE OF PROTECTIVE CLOSURE ON THE OUTLET PORT STARTING AT THE SUB ASSEMBLY STAGE.

(E) OPERATIONAL USE
NO ACTION FOR FIRST FAILURE - NOT DETECTABLE. IF BURST DISC AND RELIEF VALVE FAIL OPEN OR LEAK, USE PERIGEE ADJUST BURN TO DEPLETE PROPELLANT FROM LEAKING POD (OUT OF PLANE COMPONENT IF NECESSARY) & REDUCE DELTA V REQUIREMENT FOR DEORBIT. AFTER LEAKED PROPELLANT HAS DISPERSED, PERFORM DEORBIT WITH GOOD POD. IF LEAK RATE EXCESSIVE, USE MIXED CROSSFEED DEORBIT BURN FOR ISOLATABLE LEAK (OX SIDE). FOR FUEL SIDE LEAK, PERFORM DEORBIT WITH OTHER POD (YCG OFFSET).