SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ORBITAL MANEUVER FMEA NO 03-3 -4506 -1 REV:11/14/87

ASSEMBLY :ENGINE SUBSYSTEM
P/N RI :MC621-0009
P/N VENDOR:1186770
QUANTITY :4
:SP-31 SP-32
:SERIES VALVE-EACH ENGINE

CRIT. FUNC: 1R
CRIT. EDW: 3

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

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

PREPARED BY:		APPROVED BY:		APPROVED BY (NASA):	
DES	V F ROZNOS	DES		SSM	
REL	C M AKERS	REL		REL	
QE	W J SMITH	QE		QE	

ITEM:
VALVE ASSEMBLY, ENGINE PURGE, GN2, SOLENOID, N.C., SPRING LOADED.

FUNCTION:
SERIES VALVES ARE USED FOR POSTFIRE PURGE OF PROPELLANT FROM THE REGENERATIVE COOLING CHANNELS, INJECTOR AND COMBUSTION CHAMBER TO PREVENT FREEZING, POTENTIAL CHANGE IN PROPELLANT LEAD CHARACTERISTICS OR HARD STARTS RESULTING FROM RESIDUAL PROPELLANT. A SINGLE SOLENOID IS USED TO OPEN EACH VALVE AND IS SPRING LOADED CLOSED. ITEM INCLUDES ORIFICE, CHECK VALVE AND TEST PORT.

FAILURE MODE:
INTERNAL LEAKAGE, FAILS OPEN, FAILS TO CLOSE, FAILS TO REMAIN CLOSED.

CAUSE(S):
CONTAMINATION, CORROSION, MATERIAL DEFECT, SPRING BREAKS, POPPET LEAKS, SEAT CRACKS, PROPELLANT FREEZES, ELECTRICAL FAILURE, VIBRATION.

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

(A) LOSS OF REDUNDANCY (2 FAILURES RESULT IN LOSS OF PNEUMATIC SYSTEM PRESSURANT & GAS INGESTION TO ENGINE).

(B) NO EFFECT UNLESS SERIES VALVES FAIL.

(C) NO EFFECT.

(D) NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECT - POTENTIAL LOSS OF CREW/VEHICLE DUE TO INABILITY TO PERFORM DEORBIT BURN. 1R EFFECT ASSUMES FAILURE OF OTHER PURGE VALVE AND OTHER ENGINE AND INADEQUATE PROPELLANT FOR RCS DEORBIT. FAILURE OF SERIES VALVE NOT DETECTABLE IN FLIGHT.

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

(A) DESIGN

PROPELLANT COMPATIBLE MATERIALS ARE USED. AN 18-MICRON FILTER LIMITS THE POTENTIAL FOR CONTAMINATION TO CAUSE LEAKAGE. SERIES VALVE REDUNDANCY IS PROVIDED FOR THE LEAKAGE FAILURE MODE. THE DESIGN FACTOR OF SAFETY IS 2.4. REDUNDANT ENGINES ARE PROVIDED EITHER OF WHICH IS ADEQUATE FOR DE-ORBIT. THE PURGE VALVE ASSEMBLY CHECK VALVE PREVENTS FUEL CONTAMINANTS IN THE PURGE VALVE ASSEMBLY.

(B) TEST

QUALIFICATION TESTS
THERMAL CYCLE (-23 TO +150 DEG F.). ENDURANCE (2440 CYCLES). HANDLING SHOCK. BURST (1080 PSI - 5500 ACTUAL BY TEST). ALSO QUALIFIED AS PART OF ENGINE ASSY - 138 HOT-FIRE TESTS DURING ENGINE QUAL, 498 TESTS AT SYSTEM LEVEL AT WSTF, VIBRATION TEST AT ENGINE LEVEL.

ACCEPTANCE TESTS
EACH UNIT VISUAL INSPECTIONS, PROOF PRESSURE, ELECTRICAL CHECKS, PULL-IN AND DROP-OUT VOLTAGE, LEAKAGE, FLOW CALIBRATION, CLEANLINESS.

GROUND TURNAROUND
V43CB0.197 PERFORMS PURGE VALVE LEAK AND FUNCTIONAL TESTS FOR FIRST FLIGHT AND ON FIVE FLIGHT INTERVALS.
V43CB0.280 PERFORMS PRESSURE DECAY EACH FLIGHT FOR PNEUMATIC SYSTEM. GN2 ACCUMULATOR PRESSURE MONITORED DURING FLIGHT FOR EVIDENCE OF LEAKAGE (MULTIPLE FAILURES REQUIRED FOR DETECTION).

(C) INSPECTION

RECEIVING INSPECTION
MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL 200 AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, ASSEMBLY AND INSTALLATION PROCEDURES ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. VISUAL AND DIMENSIONAL INSPECTION OF VALVE BODY AND COMPONENTS DURING FABRICATION IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
PENETRANT AND RADIOGRAPHIC INSPECTION OF WELDS ARE VERIFIED BY INSPECTION.

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

TESTING
TEST EQUIPMENT AND TOOL CALIBRATION ARE 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 OPERATIONAL FAILURE HISTORY. CAR AB4396 RECORDS A MINOR LEAK OF 4.5 SCCH (VERSES 2.5 SCCH ALLOWABLE) DUE TO THERMAL CONTRACTION OF THE SEAL DURING LOW TEMPERATURE TEST. THIS IS WITHIN THE VEHICLE CHECKOUT REQUIREMENTS OF 10 SCCH.

(E) OPERATIONAL USE
NO ACTION FOR FIRST FAILURE. PURGE VALVE LEAKAGE RATE IN EXCESS OF 334 SCCS RESULTS IN FAILED ENGINE. COMPLETE MISSION REQUIREMENTS USING CROSSFEED FOR PROPELLANT UTILIZATION. REDLINE ADDITIONAL PROPELLANT FOR RCS BACKUP DEORBIT. NEXT PLS DEORBIT IF PROPELLANT FOR RCS BACKUP NOT AVAILABLE. POSSIBLE MISSION IMPACT. DECREASED PROPELLANT AVAILABLE FROM OMS TO RCS THROUGH INTERCONNECT FOR ON-ORBIT OPERATION.