SHUTTLE CRITICAL ITEMS LIST - ORBITER

[redacted]STEM :ORBITAL MANEUVER FMEA NO 03-3 -4502 -1 REV:12/05/87

[redacted]LY :ENGINE SUBSYSTEM
[redacted] RI :MC276-0017-0401
[redacted] VENDOR:
[redacted]NTITY :2
:QD SP-27
:ONE FOR EACH ENG SUB-SYS

CRIT. FUNC: 1R
CRIT. HDW: 3

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

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

[redacted]PARED BY:		APPROVED BY:	APPROVED BY (NASA):
D W CARLSON	DES		SSM
C M AKERS	REL		REL
W J SMITH	QE		QE

[redacted]M:
COUPLING, GN2 FILL. (MD 425, 525)

[redacted]CTION:
[redacted]N2 TANK IS FILLED OR VENTED FROM THIS COUPLING WHICH IS A SERVICING [redacted]ONNECTION ACCESSIBLE AT THE ENGINE SERVICING PANEL. ITEM INCORPORATES [redacted]NTERNAL SEAL AND A PRESSURE CAP WITH AN ADDITIONAL SEAL INSTALLED PRIOR [redacted]O FLIGHT. GN2 FILL VALVE PROVIDES REDUNDANCY FOR LEAKAGE.

[redacted]URE MODE:
[redacted]NAL LEAKAGE (SEAL LEAKAGE)

[redacted]SE(S):
[redacted]ONTAMINATION, EXCESS OR IMPROPER USE (EXCESS TORQUE, SEAL DAMAGE), [redacted]NADEQUATE MAINTENANCE (OF GSE HALF), NO LINE SUPPORT FOR GROUND HALF [redacted]OUPLING. SHAFT OR BORE BENT, RETAINING NUT LOOSENS NEGATING CAP SEAL [redacted]EDUNDANCY.

[redacted]CT(S) ON:
[redacted]) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

[redacted]) NO EFFECT. LOSS OF REDUNDANCY FOR OVERBOARD LEAKAGE.

[redacted],C,D) NO EFFECT.

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(E) FUNCTIONAL CRITICALITY EFFECT - POSSIBLE LOSS OF CREW/VEHICLE DUE TO INABILITY TO PERFORM DEORBIT BURN (FAILURE OF BOTH OMS ENGINES AND INADEQUATE PROPELLANT FOR RCS DEORBIT). 1R EFFECT ASSUMES FAILURE OF COUPLING CAP SEAL, COUPLING SEAL, GN2 ISOLATION VALVE, GN2 CHECK VALVE, OTHER OMS ENGINE AND ACCUMULATOR SUCH THAT OMS BI-PROP VALVES CANNOT BE ACTUATED IN EITHER POD; AND THAT ADEQUATE PROPELLANT DOES NOT EXIST FOR RCS BACK-UP DEORBIT.

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

(A) DESIGN
DESIGN FACTORS - PROOF PRESSURE OF 1.5 DEMONSTRATED EACH UNIT. BURST- OF 2.0 DEMONSTRATED BY ANALYSIS AND QUAL TEST. COMPLETE STRESS ANALYSIS PERFORMED. GROUND HALF COUPLINGS/LINES SUPPORTED TO LIMIT STRESS ON COUPLINGS AND PREVENT DAMAGE TO SEALS AND WELD JOINTS. CAP MINIMIZES LEAKAGE POTENTIAL, AND PROVIDES REDUNDANT SEAL. RETAINING NUT (CAP SEAL IS LOCKWIRED. GN2 FILL VALVE PROVIDES ADDITIONAL REDUNDANCY. REDUNDAN ENGINES ARE PROVIDED.

(B) TEST

QUALIFICATION TESTS
(3 UNITS). RANDOM VIBRATION (POPPET OPEN AND CAP ON) - 48 MIN EACH AXIS. SHOCK - BENCH AND DESIGN. THERMAL - (+210 TO -30 DEG. F.). ENDURANCE - 600 FUNCTIONAL CYCLES, 800 PRESSURE CYCLES. BENDING AND AXIAL LOADS - 50 FT-LB, 50 LBS. BURST TEST - 10,000 PSI. ALSO QUALIFIED AS PART OF POD ASSEMBLY - VIBRO-ACOUSTIC TESTING AT JSC, HOT-FIRE TEST PROGRAM AT WSTF.

ACCEPTANCE TEST
EACH UNIT. PROOF PRESSURE. FUNCTIONAL TESTS. EXTERNAL LEAKAGE TESTS PERFORMED BEFORE AND AFTER OPERATING CYCLES.

GROUND TURNAROUND
V43CB0.210 PERFORMS FIRST FLIGHT EXTERNAL LEAK CHECKS.
V43CB0.200 REQUIRES LEAK CHECK FOR EACH COUPLING AND CAP USED DURING TURNAROUND OPERATIONS (NOT INCLUDING SERVICING) FOR FIRST FLIGHT AND EVERY 5 FLIGHTS THEREAFTER.
V43CB0.206 PERFORMS CAP LEAK CHECK EVERY TIME CAP IS REMOVED.
V43CF0.030 PERFORMS PNEUMATIC SYSTEM GN2 SERVICING EVERY FLIGHT AND PRESSURE CHECK ON FILL COUPLING AND FILL VALVE BEFORE GSE IS DISCONNECTED.
GN2 TANK PRESSURE MONITORED EACH FLIGHT FOR LEAKAGE.

(C) INSPECTION

RECEIVING INSPECTION
MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS 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. VISUAL INSPECTION OF SEALS FOR DAMAGE IS VERIFIED BY INSPECTION.

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.

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.

FAILURE HISTORY
NO FAILURES OF THE COUPLING HAVE OCCURRED IN THIS USE APPLICATION. SEE FMEA 03-3-1002-1 FOR A TOTAL FAILURE HISTORY ON THIS COUPLING (MC276-017).

OPERATIONAL USE
FOR EXTERNAL LEAKAGE, AFFECTED ENGINE WILL NOT BE USED FOR ON-ORBIT BURNS. SAVE ACCUMULATOR PRESSURE FOR DEORBIT BURN START. FOR LOSS OF ACCUMULATOR PRESSURE COMPLETE MISSION REQUIREMENTS USING CROSSFEED FOR PROPELLANT UTILIZATION. REDLINE ADDITIONAL PROPELLANT FOR RCS BACKUP DEORBIT. NEXT PLS DEORBIT IF SUFFICIENT PROPELLANT NOT AVAILABLE. POSSIBLE MISSION IMPACT. DECREASE IN PROPELLANT AVAILABLE FROM OMS TO RCS FOR INTERCONNECT FOR ON-ORBIT OPERATION.