

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ORBITAL MANEUVER FMEA NO 03-3 -4003 -1 REV: 12/01/87

ASSEMBLY : ENGINE SUBSYSTEM CRIT. FUNC: 1
 P/N RI : MC621-0009 CRIT. HDW: 1
 P/N VENDOR: 1186417, 1186418 VEHICLE 102 103 104
 QUANTITY : 4 EFFECTIVITY: X X X
 : 1 OX & 1 FU DISCHARGE PHASE(S): PL LO X OO X DO X LS
 : LINES PER ENG SUBSYS

PREPARED BY: DES V F ROZNOS REL C M AKERS QE J M SMITH
 REDUNDANCY SCREEN: A- B- C-
 APPROVED BY: DES *[Signature]* SSM *[Signature]*
 REL *[Signature]* REL *[Signature]*
 QE *[Signature]* QE *[Signature]*

ITEM:
 CONNECTOR, FLEXIBLE, ENGINE ALIGNMENT, PROPELLANT LINE.

FUNCTION:
 A 3-PLY 321 STAINLESS STEEL EXTERNALLY CONSTRAINED BELLOWS PLUS RIGID TUBE IS PROVIDED FOR SYSTEM CONNECTION AND ALIGNING THE ENGINE TO THE BI-PROP VALVE FOR EASE OF REMOVAL AND INSTALLATION. UNIT IS LOCATED DOWNSTREAM OF BI-PROP VALVE. CRES 321 IS UTILIZED FOR BOTH THE BRAID AND THE CONVOLUTIONS.

FAILURE MODE:
 STRUCTURAL FAILURE RUPTURE, EXTERNAL LEAKAGE.

CAUSE(S):
 WELD DEFECT, CORROSION-PROPELLANT AND BY-PRODUCT EXPOSURE, INSTALLATION DAMAGE, PRESSURE SURGE, FLOW INDUCED VIBRATION, FLIGHT VIB.

EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
 (A) LOSS OF REDUNDANCY - USE OF ONE ENGINE. (ENGINE ALIGNMENT CONNECTOR IS DOWNSTREAM OF INLET VALVE & CAN BE ISOLATED).
 (B) DEGRADATION OF INTERFACE SUBSYSTEM. CROSSFEED REQUIRED FOR PROPELLANT UTILIZATION.

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(C) POSSIBLE EARLY MISSION TERMINATION. REDLINE ADDITIONAL PROPELLANT FOR RCS BACKUP DEORBIT. NEXT PLS DEORBIT IF SUFFICIENT PROPELLANT NOT AVAILABLE.

(D) POSSIBLE LOSS OF CREW/VEHICLE IF LEAK RESULTS IN EXCESSIVE PROPELLANT LOSS OR DAMAGE TO TPS/STRUCTURE.

DISPOSITION & RATIONALE:

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

(A) DESIGN

PROPELLANT COMPATIBLE MATERIALS ARE USED. FACTOR OF SAFETY IS 1.5. MULTIPLY BELLOWS ARE UTILIZED. FLOW INDUCED VIBRATION ANALYSIS AND STRESS ANALYSIS ARE CONDUCTED TO VERIFY ACCEPTABLE DESIGN.

(B) TEST

QUALIFICATION TESTS

VIBRATION UNDER SIMULATED MISSION CONDITIONS, ENDURANCE CYCLING (2400 CYCLES), PROPELLANT EXPOSURE, BURST (825 PSI). USED ON ENGINES FOR ENGINE QUAL AND SYSTEM QUAL - 138 TESTS DURING ENGINE QUAL PROGRAM. 417 TEST DURING POD QUAL PROGRAM.

ACCEPTANCE TESTS

EXAMINATION OF PRODUCT, WELD INSPECTION, FUNCTIONAL AND LEAKAGE TESTS PRESSURE DROP, CLEANLINESS.

GROUND TURNAROUND

V43CBO.210 PERFORMS FIRST FLIGHT LEAK CHECKS.

V43CEO.030 PERFORMS DETAILED INTERNAL VISUAL INSPECTION OF FLUID SYSTEM, EFFECTIVITY WHENEVER POD IS REMOVED, NOT TO EXCEED 3 FLIGHT INTERVAL.

V43CEO.120 REQUIRES PERIODIC SAMPLING OF STATIC AIR IN VARIOUS POD INTERNAL COMPARTMENTS FOR DETECTION OF MINOR PROPELLANT LEAKAGE.

V43CBO.275 PERFORMS PRESSURE DECAY DOWNSTREAM OF ENGINE EVERY 5TH FLIGHT. PROPELLANT TANK PRESSURE AND TEMPERATURE MONITORED EACH FLIGHT FOR EVIDENCE OF LEAKAGE.

(C) INSPECTION

RECEIVING INSPECTION

MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CONNECTOR IS CLEANED PER ALRC SPECIFICATION. CLEANLINESS TO LEVEL 200 FOR MMH, 200A FOR NTO, 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 AND DIMENSIONAL INSPECTIONS OF COMPLETED ASSEMBLY ARE VERIFIED BY INSPECTION. CONCENTRIC WELDED SLEEVES 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 ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

NONE.

(E) OPERATIONAL USE

THE SOURCE OF A LEAK DOWNSTREAM OF THE BI-PROP VALVE MAY BE DIFFICULT TO DIAGNOSE. FOR SIGNIFICANT LEAKAGE USE PERIGEE ADJUST BURN TO DEplete PROPELLANT FROM LEAKING POD AND REDUCE DELTA. REQUIREMENTS FOR DEORBIT. AFTER LEAKED PROPELLANT HAS DISPERSED, PERFORM DEORBIT BURN WITH GOOD POD. ISOLATE AFFECTED ENGINE AND USE 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.