

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ORBITAL MANEUVER FMEA NO 03-3 -4501 -1 REV: 12/01/87

ASSEMBLY : ENGINE SUBSYSTEM CRIT. FUNC: 1  
 P/N RI : MC621-0009 CRIT. HDW: 1  
 P/N VENDOR: 1186829 VEHICLE 102 103 104  
 QUANTITY : 2 EFFECTIVITY: X X X  
 : ONE FOR EACH ENG SUBSYS PHASE(S): PL X LO X OO X DO X LS

REDUNDANCY SCREEN: A- B- C-  
 PREPARED BY: APPROVED BY: APPROVED BY (NASA):  
 DES V F ROZNOG DES *[Signature]* SSM *[Signature]*  
 REL C M AKERS REL *[Signature]* REL *[Signature]* 12-3-97  
 QE W J SMITH QE *[Signature]* QE *[Signature]* 12-3-87

ITEM: TANK, PRESSURANT, GN2, PNEUMATIC ACTUATION SUPPLY, TITANIUM (6AL4V).

FUNCTION:  
 STORES GASEOUS NITROGEN AT A MAXIMUM WORKING PRESSURE OF 3000 PSI AND PROVIDES PRESSURIZING GAS FOR THE ENGINE BI-PROPELLANT VALVE ACTUATORS. TANKS ARE LOCATED ON THE ENGINE SUB ASSEMBLY IN EACH POD.

FAILURE MODE:  
 STRUCTURAL FAILURE, RUPTURE, EXTERNAL LEAKAGE.

CAUSE(S):  
 MATERIAL DEFICIENCY, WELD DEFECT, FAULTY FABRICATION, STRESS RISER TEST DAMAGE, STRESS CORROSION, PROPELLANT LEAK, SHOCK, VIBRATION.

EFFECT(S) ON:  
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE  
 (A) LOSS OF FUNCTION. LOSS OF ABILITY TO RESTART ENGINE.  
 (B) LOSS OF INTERFACE SUBSYSTEM. POSSIBLE DAMAGE TO THE OME HEAT SHIELD.  
 (C) POSSIBLE EARLY MISSION TERMINATION. REDLINE ADDITIONAL PROPELLANT FOR RCS BACKUP DEORBIT. NEXT PLS DEORBIT IF SUFFICIENT PROPELLANT NOT AVAILABLE.  
 (D) POSSIBLE POD DAMAGE AND CREW LOSS IF FAILURE PROPAGATES.

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

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b) DESIGN

THE FACTOR OF SAFETY (PROOF) IS 2.0 X WORKING PRESSURE AND THE FACTOR OF SAFETY (BURST) IS 4.0. DESIGN BURST IS 7200 PSIG. ACTUAL BURST WAS 13,500 PSI (TANK FLANGE FAILURE). TANKS ARE OF LOW CAPACITY (5.0 IN DIAMETER). COMPLETE STRESS AND FLAW GROWTH ANALYSIS FOR EACH TANK SEGMENT WAS PERFORMED. FRACTURE CONTROL REQUIREMENTS ARE IMPOSED. SHRAPNEL NOT PRODUCED IN RUPTURE FAILURE DUE TO LOW STRESS LEVELS.

b) TEST

QUALIFICATION TEST

THERMAL CYCLES (-23 TO +150 DEG F), ENDURANCE (1000 PRESSURIZATION CYCLES), VIBRATION TESTING AT ENGINE LEVEL. QUALIFIED AS PART OF ENGINE ASSEMBLY - 138 FIRINGS DURING ENGINE QUAL, 498 FIRINGS AT POD LEVEL AT WSTF.

ACCEPTANCE TEST

EXAMINATION OF PRODUCT, WELD EVALUATION FOR EVIDENCE OF STRESS RISER OR OTHER FLAWS, PROOF PRESSURE AND LEAK.

GROUND TURNAROUND

V43CBO.210 PERFORMS FIRST FLIGHT LEAK TEST.

V43CBO.280 PERFORMS PRESSURE DECAY OF GN2 SYSTEM EACH FLIGHT.

V43CFO.030 PERFORMS PNEUMATIC SYSTEM GN2 SERVICING AND VERIFIES CONFORMANCE TO SE-S-0073 EVERY FLIGHT.

GN2 TANK AND ACCUMULATOR PRESSURE MONITORED EACH FLIGHT FOR INDICATIONS OF LEAKAGE.

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.

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. ULTRASONIC INSPECTION OF ANNEALED MIL-T-9047 BAR STOCK IS VERIFIED BY INSPECTION.

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TESTING

TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. ACCEPTANCE TEST IS VERIFIED BY INSPECTION. PRESSURIZATION CYCLE HISTORY LOG IS VERIFIED BY INSPECTION. MICRO-ETCH OF HEMISPHERES FOR ALPHA SEGREGATION IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

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

(D) FAILURE HISTORY  
NONE.

(E) 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.