

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : PURGE, VENT & DRAIN FMEA NO 01-5 -332406-1 REV:09/24/87

ASSEMBLY : WCCS
 P/N RI : V070-381256, V070-383102 CRIT. FUNC: 2
 P/N VENDOR: V070-383101, V070-383121 CRIT. HDW: 2
 QUANTITY : 4 VEHICLE 102 103 104 -
 : FOUR RUNS EFFECTIVITY: X X X -
 : PHASE(S): PL LO X OO X DO X LS

PREPARED BY: REDUNDANCY SCREEN: A-N/A, B-N/A, C-N/A
 DES F A FERRIS APPROVED BY: APPROVED BY (NASA):
 REL J S MULLEN REL *[Signature]* SSM *[Signature]*
 QE *[Signature]* QE *[Signature]* QE *[Signature]*

ITEM:
 TUBING, INNER CAVITY SYS AND INNER AND OUTER HATCH CAVITY SYSTEMS.

FUNCTION:
 THIS ITEM CONSISTS OF A NETWORK OF TUBING WHICH CONNECTS THE COMPONENT OF THE WINDOW PURGE SYSTEM. ALL TUBING JOINTS ARE BRAZED CONNECTION EXCEPT THE THREADED FASTENERS AND DYNATUBE FITTINGS.

FAILURE MODE:
 LEAKAGE, EXTNL

CAUSE(S):
 BROKEN LINE (FRACTURE), LOOSE FLUID FITTING.

- EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
 (A) FUNCTIONAL DEGRADATION DUE TO INTRODUCTION OF MOIST AIR INTO THE INNER WINDOW CAVITIES.
 (B) LOSS OF CABIN ATMOSPHERE OVERBOARD THROUGH INNER CAV. PURGE/VENT LINES.
 (C) POSSIBLE LOSS OF MISSION DUE TO EXCESSIVE LOSS OF CABIN ATMOSPHERE.
 (D) NONE. POSSIBLE FOGGING OF WINDOWS IF CABIN TEMPERATURE AND RELATIVE HUMIDITY ARE OUT OF NORMAL RANGE. THE LEFT AND RIGHT HAND WINDOW CAVITIES ARE ISOLATED FROM ONE ANOTHER AND THE VEHICLE CAN BE SAFELY CONTROLLED USING EITHER THE LEFT OR RIGHT HAND WINDOWS.

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

(A) DESIGN
 THE SYSTEM USES BRAZED JOINTS INSTEAD OF MECHANICAL FITTINGS. THE MAXIMUM TUBE DIAMETER IN THE CABIN IS .343 INCH DIAMETER WHICH, IF IT LEAKS, IS LESS THAN THE .45 INCH DIAMETER FLOW MAKE-UP CAPABILITY OF THE ECLSS. THE STAINLESS STEEL TUBING IS CAPABLE OF 3000 PSID OPERATION AND THE MAXIMUM OPERATING PRESSURE IS 14.7 PSID WHICH YIELDS A FACTOR OF SAFETY

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(F.O.S.) OF 204. THE F.O.S. IS 115 BY ANALYSIS FOR THE ULTIMATE HOOP STRESS OF 1225.5 PSI. THE F.O.S IS 513 BY ANALYSIS FOR THE ULTIMATE CRUSH PRESSURE OF 16.0 PSID ON THE HATCH TUBING AND THE F.O.S. IS 1785 BY ANALYSIS FOR THE ULTIMATE CRUSH PRESSURE OF 4.6 PSID ON THE REMAINING TUBING. THE F.O.S IS 27 BY ANALYSIS FOR THE ULTIMATE SHOCK LOAD OF 5172 PSI.

(B) TEST

A TYPICAL WCCS INSTALLATION UNDERWENT CERTIFICATION TESTS SUBJECTING THE HARDWARE TO THE DESIGN RANDOM VIBRATION ENVIRONMENT FOR THE EQUIVALENT OF 400 MISSIONS. THE ACCELERATION SPECTRAL DENSITY TEST ENVIRONMENT OF 3.0 G SQ./HZ EXCEEDS THE 1.3 G SQ./HZ DESIGN REQUIREMENT. THE FINAL INSTALLATIONS UNDERGO BLOWDOWN TESTS AT 45 PSIG TO MEET CLEANLINESS CRITERIA AND LEAKAGE TESTS PRIOR TO THE FIRST FLIGHT. THE SUBSYSTEM RETESTED FOR LEAKAGE CRITERIA EACH TURNAROUND PER THE OMRSD BY MEANS OF A PRESSURE DECAY TEST. THE WINDOW CAVITY CONDITIONING SYSTEM TUBING IS CERTIFIED UNDER CR 14-381071-002B.

(C) INSPECTION

RECEIVING INSPECTION

CERTIFICATIONS OF RAW MATERIAL AND PARTS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

VERIFICATION OF CLEANLINESS OF INSTALLED SYSTEM PER DRAWING AND SPECIFICATION MAINTAINED FROM BEGINNING TO END.

ASSEMBLY/INSTALLATION

X-RAYS ARE VERIFIED BY INSPECTION. IN PROCESS INSPECTION OF DETAIL COMPONENTS AND SUB-ASSEMBLIES PER APPLICABLE SPECIFICATIONS AND DRAWING REQUIREMENTS VERIFIED ON MANUFACTURING ORDERS. TORQUING REQUIREMENT VERIFIED. TUBE ENDS/SEALING SURFACE PROPERLY PROTECTED AND VERIFIED PER INSPECTION.

NONDESTRUCTIVE EVALUATION

RADIOGRAPHIC INSPECTION OF BRAZED TUBE JOINTS.

CRITICAL PROCESSES

TUBE BRAZING PROCESS VERIFIED BY INSPECTION.

TESTING

INSPECTION BUY-OFF OF LEAK TEST AND FUNCTIONAL TEST AFTER INSTALLATION COMPLETE.

(D) FAILURE HISTORY

NO LEAKAGE FAILURES HAVE BEEN EXPERIENCED TO DATE. SIMILAR TUBING TECHNIQUES EXHIBITED HIGH RELIABILITY ON APOLLO CSM/SKYLAB PROGRAMS.

(E) OPERATIONAL USE

NO IN-FLIGHT CORRECTIVE ACTION IS POSSIBLE.