

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : PURGE, VENT & DRAIN FMEA NO 01-5 -332403-1 REV:09/23/87

ASSEMBLY : WCCS
P/N RI : V070-382164, V070-381071
P/N VENDOR: V070-384026
QUANTITY : 2
: TWO
:

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

PREPARED BY: DES F A FERRIS
REL J S MULLEN
QE *Handwritten initials*

REDUNDANCY SCREEN: A-N/A B-N/A C-N/A
APPROVED BY: *Handwritten signature*
DES *Handwritten signature*
REL *Handwritten signature*
QE *Handwritten signature*

APPROVED BY (NASA):
SSM *Handwritten signature*
PZL *Handwritten signature*
QE *Handwritten signature*

ITEM:
TUBING, SIDE/OVERHEAD WINDOW OUTER CAVITY SYSTEM.

FUNCTION:
THIS ITEM CONSISTS OF A NETWORK OF TUBING WHICH CONNECTS THE COMPONENTS OF THE WINDOW PURGE/VENT SYSTEMS. ALL TUBING JOINTS ARE BRAZED CONNECTIONS 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 OUTER WINDOW CAVITIES.

(B) MAY CONTAMINATE WINDOW SURFACES.

(C,D) MAY AFFECT RATES OF VENTING/REPRESS OF THE OUTER WINDOW CAVITIES. LEAK RATE MAY RESULT IN OVERPRESSURE OF SIDE AND OVERHEAD WINDOW THERMAL PANES. SUBSEQUENT LOSS OF REDUNDANT AND PRESSURE PANES RESULTS IN LOSS OF CREW/VEHICLE.

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

(A) DESIGN
THE SYSTEM USES STANDARD FLUID FITTINGS CAPABLE OF HIGH PRESSURE LOADING (DYNATUBES WHICH DO NOT TEND TO LOOSEN IF PROPERLY TORQUED - REFERENCE JSC TEST REPORT WTS/M597 DATED 3/31/77) AND BRAZED JOINTS INSTEAD OF MECHANICAL FITTINGS. 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 (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 1785 BY ANALYSIS FOR THE ULTIMATE CRUSH PRESSURE OF 4.6 PSID. THE F.O.S. IS 27 BY ANALYSIS FOR THE ULTIMATE SHOCK LOAD OF 5172 PSI.

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(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 TUBING IS RETESTED FOR LEAKAGE CRITERIA EACH TURNAROUND PER THE OMRSO 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.

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.

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

OPERATIONAL EFFECTS - DURING THE ASCENT PHASE, IF ALL REDUNDANCY TO THIS FUNCTION IS LOST AND A THERMAL PANE RUPTURES AN RTLS WILL BE DECLARED DEPENDING ON THE FLIGHT STAGE. CREW ACTION NONE. MISSION CONSTRAINT - NONE.