

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : CREW MODULE SEALS FMEA NO 01-4 -CS12 -1 REV:03/29/88

ASSEMBLY : WINDOW CAVITY CONDITIONING SYSTEM CRIT. FUNC:
P/N RI : V070-311456, -311471 CRIT. HDW:
P/N VENDOR: VEHICLE 102 103 104
QUANTITY : 9 EFFECTIVITY: X X X
: 6 WINDSHIELD, 2 OVERHEAD, PHASE(S): PL X LO X OO X DO X LS
: 1 SIDE HATCH

REDUNDANCY SCREEN: A- B- C-
PREPARED BY: APPROVED BY: APPROVED BY (NASA):
DES W. HENRY DES W. H. Henry 7/28/88 SSM W. H. Smith 8/22/88
REL D. MAYNE REL D. M. Mayne 8/22/88 REL W. H. Smith 8/22/88
QE W. SMITH QE D. M. Mayne 7-25-88 QE W. H. Smith 8/22/88

ITEM: ENVIRONMENTAL BARRIER

FUNCTION: THE FLEXIBLE BARRIER SEALS THE CAVITY BETWEEN THE THERMAL PANE AND REDUNDANT PANE OF EACH WINDSHIELD WINDOW, EACH OVERHEAD WINDOW AND THE SIDE HATCH WINDOW. THE BARRIER PROVIDES A CONTROLLED VOLUME FOR THE PURGE, VENT AND DRAIN SYSTEM, WHICH OPERATES PASSIVELY TO PREVENT OVERPRESSURE OF THE THERMAL PANE DURING ASCENT AND DESCENT. THE BARRIER ALSO PREVENTS MOISTURE, PARTICULATES AND VOLATILE CONDENSIBLE MATERIAL FROM CONTAMINATING WINDOW SURFACES.

FAILURE MODE: LEAKAGE

CAUSE(S): CRACKS, LOW TEMPERATURE, MATERIAL DEGRADATION, DELAMINATION, STRUCTURAL DEFLECTIONS

EFFECT(S) ON: (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
(A) NONE.
(B) POSSIBLE WINDOW CONTAMINATION.
(C) POSSIBLE DEGRADED VISIBILITY THROUGH WINDOW AND RTLS ABORT IF THE THERMAL PANE FAILS DURING ASCENT PHASE.
(D) IF THE THERMAL PANE FAILS DUE TO OVERPRESSURIZATION AND IS SUBSTANTIALLY GONE FROM ITS FRAME, HEATING ON REENTRY WILL DAMAGE UNDERLYING STRUCTURE AND MAY CAUSE FAILURES OF REDUNDANT AND/OR PRESSURE PANE, RESULTING IN LOSS OF CREW AND VEHICLE.

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DISPOSITION & RATIONALE:

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

(A) DESIGN

THE BARRIERS ARE MOLDED SILICONE RUBBER INTEGRALLY BONDED TO ARAMID FABRIC AND TO A TITANIUM PAN AND SHIELD ON THE WINDSHIELDS AND AN ALUMINUM PAN AND SHIELD ON THE OVERHEAD WINDOWS. FABRIC WEAVE DIRECTION IS 45 DEGREES TO PERIPHERY. EXPOSED FABRIC EDGES ARE SEALED WITH SILICONE RUBBER. BARRIER WALLS ARE CONVOLUTED TO ACCOMMODATE DISPLACEMENTS OF CREW MODULE RELATIVE TO FORWARD FUSELAGE. INNER AND OUTER STRUCTURAL ATTACHMENTS ARE MADE WITH CLOSE PITCHED BOLTS THROUGH PAN AND SHIELD.

(B) TEST

QUALIFICATION TESTS: NOT COMPLETED BECAUSE TWO TEST SPECIMENS WERE DAMAGED BY TEST EQUIPMENT MALFUNCTIONS. CERTIFICATION IS BASED ON FLIGHT BY FLIGHT PRESSURE DECAY TEST DURING TURNAROUND.

ACCEPTANCE TESTS: BARRIER ASSEMBLY IS PRESSURIZED AT 7.0 + 0.5, -0.0 PSID FOR 2 MINUTES TO VERIFY NO SEPARATION OR BALLOONING. LEAK TEST IS PERFORMED AT 1.75 +/- 0.05 PSID FOR 5 MINUTES WITH PRESSURE DECAY NOT GREATER THAN 0.036 PSI IN 5 MINUTES. SILICONE MOLDING IS TESTED FOR SUSCEPTIBILITY TO CRACKS BY COMPRESSING A PERIPHERY FOLD AT 6 INCH INTERVALS IN A TEST TOOL AND INSPECTING FOR CRACKS.

OMRSD: PRESSURE DECAY TEST IS PERFORMED ON THE WINDOW CAVITY CONDITIONING SYSTEM DURING TURNAROUND FORWARD AND MID WINDOW OUTER CAVITIES, LH AND RH, EVERY TENTH FLIGHT, SIDE AND OVERHEAD WINDOW OUTER CAVITIES, LH AND RH, EVERY FLIGHT, AND SIDE HATCH WINDOW OUTER CAVITY EVERY TENTH FLIGHT. PRESSURE TEST VERIFIES INTEGRITY OF WCCS TUBING AND ENVIRONMENTAL BARRIERS. TEST PRESSURE IS 3 PSID WITH MAXIMUM ALLOWABLE PRESSURE DROP OF 0.9 PSID IN 5 MINUTES.

(C) INSPECTION

RECEIVING INSPECTION

RECEIVING INSPECTORS VERIFY MATERIAL AND PROCESS CERTIFICATIONS.

CONTAMINATION CONTROL

CLEANLINESS REQUIREMENTS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

INSPECTORS VERIFY FABRICATION AND INSTALLATION OF ENVIRONMENTAL BARRIER

CRITICAL PROCESSES

SEALING OF EXPOSED FABRIC EDGES WITH SILICONE RUBBER IS VERIFIED BY INSPECTION. MOLDING AND BONDING OF SILICONE RUBBER IS VERIFIED BY INSPECTION. POST CURE IS VERIFIED BY INSPECTION.

TESTING

INSPECTORS VERIFY 7 PSID PRESSURIZATION TEST, 1.75 PSID LEAK TEST, AND CRACK SUSCEPTIBILITY TEST.

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HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

THERE HAVE BEEN NO ACCEPTANCE TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE. QUALIFICATION TESTS WERE NOT COMPLETED.

(E) OPERATIONAL USE

IF ONE WINDOW IS FOGGED, CREW CAN USE ANOTHER WINDOW. IF A THERMAL PANI RUPTURES DURING THE ASCENT PHASE, AN RTLS ABORT WILL BE DECLARED, DEPENDING ON THE FLIGHT STAGE. FLIGHT CONSTRAINTS ON THE ASCENT TRAJECTORY, BASED ON DATA OBTAINED FROM LOAD INDICATORS, LIMIT THE PRESSURE DIFFERENTIAL ACROSS THE THERMAL PANES.