

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : CREW ESCAPE-EGRESS - PYRO FMEA NO P7-2A-480051-1 REV: 03/17/88

ASSEMBLY : EMERGENCY EGRESS WINDOW				CRIT. FUNC:	1
P/N RI : V070-553302				CRIT. HDW:	1
P/N VENDOR: V070-553303		VEHICLE	102	103	104
QUANTITY : 1 SET		EFFECTIVITY:	X	X	X
		PHASE(S):	PL	LO	OO DO LS X

PREPARED BY:		REDUNDANCY SCREEN:	A-	B-	C-
DES	R. H. YEE	APPROVED BY:	APPROVED BY (NASA):		
REL	M. B. MOSKOWITZ	DES	SSM <i>[Signature]</i>		
QE	E. M. GUTIERREZ	REL	<i>[Signature]</i>		
		QE	<i>[Signature]</i>		

ITEM:
INNER AND OUTER WINDOW SEVERANCE, EMERGENCY EGRESS

FUNCTION:
DUAL (REDUNDANT) EXPLOSIVE CORDS DETONATE, BREAKING FRANGIBLE BOLTS, JETTISONING (OUTER LEFT) OVERHEAD WINDOW AND ALLOWING INNER WINDOW TO HINGE INWARD TO PROVIDE A PATH FOR EMERGENCY EGRESS OF CREW IF SIDE MATCH IS JAMMED OR BLOCKED AFTER A CRASH LANDING.

FAILURE MODE:
FAILS TO OPEN

CAUSE(S):
DUAL PYRO FAILURES (COMBINATIONS OF ENERGY TRANSFER SYSTEM AND/OR EXPLOSIVE CORD), OVERSTRENGTH FRANGIBLE BOLT(S), EXCESSIVE CABIN PRESSURE, STRUCTURAL DEFORMATION

EFFECT(S) ON:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) INNER/OUTER WINDOW ASSEMBLY WILL NOT SEPARATE AND/OR INNER WINDOW WILL NOT ROTATE DOWN AND LOCK.

(B,C) NONE.

(D) POTENTIAL LOSS OF CREW IF NO ESCAPE PATH EXISTS FROM ORBITER.

DISPOSITION & RATIONALE:

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

(A) DESIGN
DUAL (REDUNDANT) PYROTECHNIC SYSTEM, EITHER ONE WILL PERFORM FUNCTION WITH 85% CHARGE.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

S402509
ATTACHMENT -
Page 2 of 7

SUBSYSTEM : CREW ESCAPE-EGRESS - PYRO FMEA NO P7-2A-480051-1 REV:03/17/88

(B) TEST

DESIGN VERIFICATION TESTS: FULL SIZE PANELS (9 INNER/7 OUTER), HIGH/LOW/AMBIENT, SINGLE AND DUAL CORD.

QUALIFICATION TEST: 4 INNER/4 OUTER THERMAL CYCLING, RANDOM VIBRATION, SHOCK, SALT FOG, X-RAY, N-RAY, HIGH AND LOW TEMPERATURE FIRING, SINGLE 85% AND DUAL 115% FIRINGS, SLED TEST RI/DOWNEY) 4 OF 6 STATIC SLED TESTS (INNER/OUTER WINDOW PLUS ETS) COMPLETED.

ACCEPTANCE TEST: FRANGIBLE BOLTS VERIFIED 100% DIMENSIONALLY AND CONCENTRICITY, ROCKWELL HARDNESS, THREAD VERIFICATION, SAMPLE TENSILE TESTS TO VERIFY ULTIMATE STRENGTH, WINDOW ASSEMBLIES X-RAY AND N-RAY, VISUAL INSPECTIONS.

OMRSD: NONE, HARDWARE INACCESSIBLE.

(C) INSPECTION

RECEIVING INSPECTION

MATERIALS AND PROCESS CERTIFICATIONS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS AND CONTAMINATION CONTROL REQUIREMENTS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

INSTALLATION OF FRANGIBLE BOLTS AND TORQUE, WINDOW, SEALS, ASSOCIATED COMPONENTS, CLEANLINESS AND IDENTIFICATION PERFORMED, PARTS PROTECTION VERIFIED BY INSPECTION. INNER/OUTER WINDOW SEVERANCE HARDWARE IS CERTIFIED BY NASA ENGINEERING AND QUALITY ASSURANCE.

NONDESTRUCTIVE EVALUATION

X-RAY AND N-RAY INSPECTIONS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

FILLING OF CAVITY WITH RTV TYPE MB0130-085 IS VERIFIED BY INSPECTION.

TESTING

ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : CREW ESCAPE-EGRESS - PYRO FMEA NO P7-2A-4800S1-1 REV:03/17/88

(D) FAILURE HISTORY

CAR NO. AC1817 : DURING PYRO QUAL TEST FIRING WITH SINGLE UNDERLOAD XT CHARGE, TWO FRANGIBLE BOLTS OUT OF 44 REQUIRED IN THE ASSEMBLY DID NOT BREAK (THREADED INSERT PULLED OUT OF ALUMINUM FRAME AND BOLT PULLED OUT OF INSERT) WHICH PREVENTED INNER WINDOW FROM ROTATING OPEN ON THE HINGES. LOCTITE FILLING IN THE BOLT BORE CAUSED IT TO PULL OUT OF THE ALUMINUM FRAME WHILE SUBSTANDARD THREADS CAUSED THE PROBLEM OF PULLING THE BOLT OUT OF THE INSERT; CORRECTIVE ACTION REQUIRED BOLT REDESIGN TO PREVENT LOCTITE FROM GETTING INTO BOLT BORE, INCREASE INSERT STRENGTH, AND 100% INSPECTION OF BOLT THREADS.

(E) OPERATIONAL USE

CREW CAN ATTEMPT TO FORCE INNER WINDOW DOWN WITH PRY BAR (FROM EMERGENCY TOOLS) TO VENT CABIN PRESSURE.