

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTUATION MECH-ET/ORB DOOR FMEA NO 02-4D-013300-1 REV:02/17/88

ASSEMBLY :ET/ORBITER UMBILICAL DOOR MECHANISMS	CRIT. FUNC:	1
P/N RI :V070-565102/3/4 (INBD/FWD/AFT)	CRIT. HDW:	1
P/N VENDOR:	VEHICLE	102 103 104
QUANTITY :6 (3 PER LH & RH DOOR)	EFFECTIVITY:	X X X
:(SHOWN & OPPOSITE)	PHASE(S):	PL LO X CO DO X LS

PREPARED BY:	REDUNDANCY SCREEN:	A-	B-	C-
DES R. H. YEE	APPROVED BY:	APPROVED BY (NASA):		
REL J. S. MULLEN	DES <i>R.H. Yee for A.S. Ordway</i>	SSM <i>K.C. Nichols 2/25/88</i>		
QE W. S. SMITH	REL <i>[Signature]</i>	REL <i>[Signature]</i>		
	QE <i>[Signature]</i>	QE <i>[Signature]</i>		

2/26/88

ITEM:
DOOR "UNLOCK" LATCH MECHANISM

FUNCTION:
TO SECURE THE ORBITER/ET DOORS IN THE FULLY CLOSED POSITION FOR RE-ENTRY.

FAILURE MODE:
PHYSICAL BINDING/JAMMING

CAUSE(S):
ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, LOSS OF LUBRICANT

EFFECT(S) ON:
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) LOSS OF FUNCTION, LATCHES CANNOT ENGAGE.

(B) THERMAL GRADIENTS INTO COMPARTMENT.

(C,D) POSSIBLE LOSS OF CREW/VEHICLE DUE TO DAMAGE CAUSED BY THERMAL EFFECTS IF THE DOORS CANNOT BE CLOSED AND FULLY LATCHED FOR SAFE RE-ENTRY.

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DISPOSITION & RATIONALE:

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

(A) DESIGN

EACH ORBITER/ET UMBILICAL DOOR IS PULLED TO A FULLY CLOSED AND LATCHED POSITION BY THREE (3) FOUR-BAR/OVER-CENTER UPLOCK LATCHES DRIVEN BY AN ELECTROMECHANICAL ACTUATOR THROUGH A TORQUE TUBE, BELLCRANKS AND CONNECTING-RODS. PROVISION EXISTS TO CYCLE THE ACTUATOR AND LATCH LINKAGES (TO LOOSEN STALLED/JAMMED MECHANISM). CLEANLINESS REQUIREMENTS MAINTAINED DURING ASSEMBLY, PER MA0110-311. PRINCIPLE MATERIALS USED: A-286 CRES STEEL AND INCONEL 718. SAFETY FACTOR OF 1.4 MINIMUM. DUAL ROTATING SURFACES ON BEARINGS. SPHERICAL BEARINGS USED TO COMPENSATE FOR LINKAGE MISALIGNMENT. "BAGGIE" PRECLUDES ICE FORMATION IN DOOR CAVITY AREA AND LINKAGE.

(B) TEST

QUALIFICATION TESTS: QUAL-CERTIFIED PER CR-45-565000-001, AS PART OF THE QUALIFICATION OF THE ORBITER/ET UMBILICAL CLOSEOUT DOOR MECHANISM SUBSYSTEM. CERTIFICATION BY ANALYSIS INCLUDED: PRESSURE ENVIRONMENT, FUNGUS, HUMIDITY, OZONE, RAIN, SALT SPRAY, SAND/DUST, SHOCK, ACCELERATION, THERMAL VACUUM AND MARGIN OF SAFETY. CERTIFICATION TESTS INCLUDED: STATIC TESTS (WITH LIMIT LOADING ON AN OPEN AND CLOSED DOOR; SIMULATING LIFT-OFF AND RE-ENTRY CONDITIONS), AERO-ACOUSTIC VIBRATION (SIMULATING 400 MISSION CAPABILITY AT 16-8,000 HZ), TEMPERATURE TEST (DOOR AND LATCHES CYCLED FROM OPEN/LATCHED TO CLOSED/LATCHED TO OPEN/LATCHED; 2 TIMES AT +960 +/- 20 DEG F) AND OPERATIONAL-LIFE CYCLE TEST (1,000 CYCLES; DOOR CYCLED OPEN-CLOSE-OPEN; CENTERLINE AND DOOR LATCHES CYCLED FULL EXTENSION-RETRACTION; EXPECT 500 CYCLES PER 100-MISSIONS). BOTH LATCH AND DOOR DRIVE MECHANISMS WERE CYCLED SEVERAL TIMES (DURING AN "OFF-LIMITS BAGGIE TEST") WHILE UTILIZING 0.02 INCH THICK POLYETHYLENE CLEAR PLASTIC - TO SIMULATE JAMMING CONDITIONS.

ACCEPTANCE TESTS: INSTALLED AND RIGGED PER MLO308-0058. FUNCTIONALLY TESTED DURING RIGGING AT PALMDALE AND FUNCTIONALLY TESTED AT KSC.

OMRSD: LATCH/RELEASE OPERATIONAL CHECKOUT OF RIGHT-HAND/LEFT-HAND ET DOOR UPLOCK LATCHES; MOTOR 1, MOTOR 2 AND DUAL MOTOR OPERATION. FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS, CONTAMINATION CONTROLS, AND ASSEMBLY AREA CLEANLINESS REQUIREMENTS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

ASSEMBLY VERIFIED BY INSPECTION. ALL CRITICAL TOLERANCES, DIMENSIONS, AND ADJUSTMENTS AND CHECKOUT ARE VERIFIED BY INSPECTION. LUBRICANT APPLICATION IS VERIFIED BY INSPECTION.

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NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREATMENT OF DETAIL PARTS AND BEARING INSTALLATION ARE VERIFIED BY INSPECTION.

TESTING

MEASUREMENT DEVICES, TEST EQUIPMENT, AND CALIBRATION VERIFIED BY INSPECTION. ALL TOLERANCES, DIMENSIONS, AND ADJUSTMENTS AND CHECKOUT ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING AND PARTS PROTECTION VERIFIED BY INSPECTION. PARTS PROTECTION AND HANDLING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

(E) OPERATIONAL USE

CREW WILL CYCLE LATCHES TO ATTEMPT TO DISLodge DEBRIS OR LOOSEN STALLED/JAMMED MECHANISM.