

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTUATION MECH-ET/ORB DOOR FMEA NO 02-4D-014000-1 REV:02/17/88

ASSEMBLY :ET/ORBITER UMBILICAL DOOR MECHANISMS	CRIT. FUNC:	1
P/N RI :V070-565062	CRIT. HDW:	1
P/N VENDOR:	VEHICLE	102 103 104
QUANTITY :2	EFFECTIVITY:	X X X
:1 FORWARD & 1 AFT	PHASE(S):	PL LO X OO 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.C. Gordon</i>	SSM <i>C. M. ...</i>	<i>2/25/88</i>	
QE W. S. SMITH	REL <i>W. S. Smith</i>	REL <i>W. S. Smith</i>	<i>2/25/88</i>	
	QE <i>W. S. Smith</i>	QE <i>W. S. Smith</i>	<i>2/25/88</i>	

ITEM:

DOOR TWIST-LOCK/RELEASE MECHANISM, CENTERLINE LATCHES

FUNCTION:

TO SECURE THE ET DOORS IN THE FULLY OPEN POSITION (THROUGH LIFT-OFF AND ASCENT), TO RELEASE THE ET DOORS FOR CLOSURE (AFTER ORBITER/ET SEPARATION) AND THEN RETRACT FLUSH WITH THE OUTER MOLD LINE (OML).

FAILURE MODE:

FAILS TO DISENGAGE (FROM DOORS)

CAUSE(S):

ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, FAILURE/DEFLECTION OF INTERNAL PART, THERMAL DISTORTION, PHYSICAL BINDING/JAMMING

EFFECT(S) ON:

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

(A) LOSS OF FUNCTION - CENTERLINE LATCHES WILL NOT STOW.

(B) DEGRADATION OF INTERFACE FUNCTION. DOORS CANNOT BE CLOSED. DAMAGE TO COMPARTMENT DUE TO THERMAL INGESTION DURING RE-ENTRY.

(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

THE ET DOOR CENTERLINE LATCHES, DRIVEN BY INDIVIDUAL ELECTROMECHANICAL ACTUATORS, EXTEND AND ROTATE (TO ENGAGE AND HOLD BOTH ORBITER/ET UMBILICAL DOORS FULLY OPEN FOR LIFT-OFF AND ASCENT) AND THEN ROTATE AND RETRACT FLUSH WITH THE OML (TO RELEASE BOTH DOORS FOR CLOSURE AFTER ORBITER/ET SEPARATION). EACH LATCH MECHANISM IS COMPOSED OF A T-SHAPED TWIST LOCK (TO ENGAGE THE DOORS); INNER AND OUTER CAMS, ROLLERS AND BUSHINGS (TO DIRECT MOVEMENT OF THE TWIST LOCK); WITH AN ALUMINUM COVER TO PRECLUDE ENTRY OF FOREIGN PARTICLES. PRINCIPLE MATERIALS USED: A-286 CRES STEEL AND INCONEL 718. CLEANLINESS MAINTAINED PER MA0110-311. DUAL ROTATING SURFACES ON BEARINGS. SAFETY FACTOR OF 1.4 MINIMUM.

(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 MLO308-0062. FUNCTIONALLY TESTED DURING RIGGING AT PALMDALE AND FUNCTIONALLY TESTED AT KSC.

OMRSD: OPERATIONAL CHECKOUT OF ET DOOR CENTERLINE LATCHES (UNLOCK/STOW); 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 REQUIREMENTS VERIFIED BY INSPECTION. CONTROLLED ENVIRONMENT VERIFIED BY INSPECTION. CLEANLINESS MAINTAINED PER MA0110-311 VERIFIED BY INSPECTION. CORROSION PROTECTION PER MA0608-301 VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

ASSEMBLY VERIFIED BY INSPECTION.

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NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREATING OF DETAIL PARTS AND BEARING INSTALLATION VERIFIED BY INSPECTION. RIGGING VERIFIED BY INSPECTION.

TESTING

CHECKOUT OF UNIT VERIFIED BY INSPECTION.

HANDLING/PACKAGING

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

NONE.