

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTUATION MECH-PBD FMEA NO C2-4B -001 -2 REV:03/08/88

ASSEMBLY : LATCHING MECHANISMS PBD CRIT. FUNC: 2  
 P/N RI : V070-594160/V070-594260 CRIT. HDW: 2  
 P/N VENDOR:  
 QUANTITY : 4

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

PREPARED BY:	DES	M. A. ALLEN	APPROVED BY:	DES	<i>[Signature]</i>	REDUNDANCY SCREEN:	A-	B-	C-
REL	M. B. MOSKOWITZ	REL	<i>[Signature]</i>	SSM	<i>[Signature]</i>	APPROVED BY (NASA):			
QE	W. J. SMITH	QE	<i>[Signature]</i>	REL	<i>[Signature]</i>				

ITEM:  
 LATCH ASSEMBLY, FORWARD-AFT BULKHEAD GANGED

FUNCTION:  
 GANGED LATCH SYSTEM CONTAINS A POWER DRIVE UNIT (PDU) MC287-0039 (REF. FMEA/CIL NO. 02-4B-007-3) PROVIDING THE ROTARY MOTION AND DRIVES THE PUSHRODS AND BELLCRANKS FOR PIVOTING THE HOOKS SEQUENTIALLY TO LATCH OR UNLATCH THE DOOR TO THE FORWARD AND AFT BULKHEAD ROLLER ASSEMBLIES.

FAILURE MODE:  
 FAILS TO DISENGAGE

CAUSE(S):  
 ADVERSE TOLERANCES/WEAR, THERMAL DISTORTION OF STRUCTURE, CONTAMINATION/ FOREIGN OBJECT/DEBRIS, PHYSICAL BINDING/JAMMING, LOSS OF LUBRICANT

- EFFECTS ON:
- (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
  - (A) 4-GANGED LATCH FAILS TO DISENGAGE AND ALLOW OPENING OF PAYLOAD BAY DOORS.
  - (B) NO EFFECT.
  - (C) POTENTIAL LOSS OF MISSION.
  - (D) NO EFFECT ON CREW/VEHICLE.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTUATION MECH-PBD

FMEA NO 02-4B -001 -2

REV:03/08/88

DISPOSITION & RATIONALE:

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

(A) DESIGN

LATCH AND MECHANISM MATERIALS (6AL-4V TITANIUM, INCONEL 718, A286 CRES) CHOSEN FOR HIGH STRENGTH/LOW WEAR CHARACTERISTICS. MECHANISM DESIGNED WITH POSITIVE MARGIN OF SAFETY FOR ACTUATOR STALL CONDITION AT MAXIMUM REACH TO 42 DEGREES FOR LATCH 1, 30 DEGREES FOR LATCH 2, 20 DEGREES FOR LATCH 3, AND 16 DEGREES FOR LATCH 4 FROM ACTUATOR BELLCRANK POSITION. LATCH REACH CAPABILITY EXCEEDS PREDICTED GAPS (LATCHES 1 AND 2 HAVE 1.17 AND 0.20 INCH MARGINS - LATCHES 3 AND 4 DRIVE AFTER 1 AND 2 HAVE ALREADY BEGUN DOOR CINCHING). ALL LINKAGES DESIGNED WITH DUAL ROTATING SURFACES AND DUAL LOCKING DEVICES ON PIVOT SHAFTS. DESIGN OF THE ACTUATION SYSTEM PERMITS PARTIAL WORKAROUND OF THIS FAILURE MODE BY EXTRAVEHICULAR ACTIVITY (EVA) CREW (PAYLOADS MAY EFFECT LATCH ACCESSIBILITY). LATCH MECHANISM DESIGNED FOR WORST CASE THERMAL CONDITION.

(B) TEST

QUALIFICATION TESTS: THE QUALIFICATION ACTUATOR IS CERTIFIED PER CR-29-287-0039-0001D (REF. FMEA/CIL 02-4B-007-3). THE PAYLOAD BAY DOOR LATCHING MECHANISM IS CERTIFIED PER CR-29-594160-001D FOR FORWARD MECHANISM AND CR-29-594260-001E FOR AFT MECHANISM. SYSTEM QUALIFICATION TESTS ON 15 FOOT PAYLOAD BAY DOOR TEST ARTICLE INCLUDED: ACCEPTANCE (TO CONFIRM ALL COMPONENTS HAVE BEEN ASSEMBLED AND RIGGED PER ML0308-0022); THERMAL CYCLE TEST (THERMALLY CYCLED 5 TIMES BETWEEN -40 DEG F AND +282 DEG F AT DOOR AND BETWEEN -120 DEG F AND +100 DEG F AT THE FORWARD BULKHEAD. THERMALLY CYCLED 5 TIMES BETWEEN +15 DEG F AND +325 DEG F AT DOOR AND BETWEEN -180 DEG F AND +120 DEG F AT AFT BULKHEAD); (THE FORWARD LATCHES WERE CYCLED AT -55 DEG F AND +50 DEG F AT BULKHEAD AND AT 0 DEG F AND +190 DEG F AT DOOR. THE AFT LATCHES WERE CYCLED AT -35 DEG F AND +60 DEG F AT BULKHEAD AND AT +40 DEG F AND +245 DEG F AT DOOR); HUMIDITY TEST ON AFT LATCH MECHANISM (PER MIL-STD-810B, METHOD 507 PROCEDURE IV, CYCLE ONE TIME AT EACH MOTOR CONDITION DURING THE SECOND CYCLE); ORBITAL FUNCTIONS (3 THERMAL CONDITIONS WITH SIMULATED THERMAL DISTORTIONS OF THE BULKHEAD); OPERATING LIFE TEST (MECHANICAL SYSTEMS CYCLED 262 TIMES AT FORWARD BULKHEAD AND 265 TIMES AT AFT BULKHEAD); ACOUSTIC TEST (PER MF0004-014C FOR 5 MINUTES). CERTIFICATION BY ANALYSIS/SIMILARITY INCLUDED FUNGUS, OZONE PACKAGING, THERMAL VACUUM, SALT SPRAY, SAND/DUST SHOCK-BASIC DESIGN, ULTIMATE LOADS, ACCELERATION, MARGIN OF SAFETY AND MISSION ACOUSTIC LIFE.

ACCEPTANCE TEST: THE LATCHING, MECHANISMS WERE RIGGED PER CONTROLLED SPECIFICATION ML0308-0022. OPERATION WHICH INCLUDED PAYLOAD BAY DOOR FUNCTIONAL AND FINAL CHECKOUT PRIOR TO FLIGHT.

OMRSD: GROUND TURNAROUND INCLUDES VISUAL INSPECTION FOR EVIDENCE OF BINDING OR JAMMING DURING DUAL MOTOR RELEASE FUNCTIONAL CHECK.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTUATION MECH-PBD      FMRA NO 02-4B -001 -2      REV:03/06/88

(C) INSPECTION

RECEIVING INSPECTION

RECEIVING INSPECTION VERIFIES MATERIAL AND PROCESS CERTIFICATIONS.

CONTAMINATION CONTROL

CLEANLINESS VERIFICATION OF MATING SURFACE IS PERFORMED PRIOR TO INSTALLATION.

ASSEMBLY/INSTALLATION

ADJUSTING SHIMS DIMENSIONS ARE VERIFIED BY INSPECTION. THREADED FASTENER INSTALLATION INCLUDING TORQUE, LOOP PIN INSTALLATION AND SAFETY WIRING OF REQUIRED FASTENERS VERIFIED BY INSPECTION. RIGGING AND ALIGNMENT IS VERIFIED BY INSPECTION. LUBRICANT APPLICATION VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREATMENT IS VERIFIED BY INSPECTION.

TESTING

ACCEPTANCE TESTING VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED.

(D) FAILURE HISTORY

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

(E) OPERATIONAL USE

THERMAL CONDITIONING OF VEHICLE CAN BE DONE TO ATTEMPT TO ALLEVIATE PROBLEM. ABORT DECISION REQUIRED IF DOOR(S) CAN NOT BE OPENED.