

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTUATION MECH-PBD FMEA NO 02-4B -108 -1 REV:03/08/88

ASSEMBLY :LATCHING MECHANISM PBD CRIT. FUNC: 1R
P/N RI :V070-594208 CRIT. HDW: 2
P/N VENDOR: VEHICLE 102 103 104
QUANTITY :16 EFFECTIVITY: X X X
:8 LATCH GANG PER SIDE PHASE(S): PL LO OO X DO LS

REDUNDANCY SCREEN: A-PASS B-N/A C-PASS
PREPARED BY: APPROVED BY: APPROVED BY (NASA):
DES M. A. ALLEN DES S. Campbell SSM R.C. Mada 2/15/88
REL M. B. MOSKOWITZ REL man... REL ...
QE W. J. SMITH QE ... QE ...

ITEM:
LINK, LOCKING, FORWARD AND AFT

FUNCTION:
DRIVES LINKAGE BETWEEN LATCH (HOOK) AND BELLCRANK FOR ALL FORWARD AND AFT GANGED LATCHES.

FAILURE MODE:
STRUCTURAL FAILURE

CAUSE(S):
MATERIAL DEFECT, STRESS CORROSION, FATIGUE, EXCESSIVE LOAD, MANUFACTURING DEFECT

- EFFECTS ON:
- (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
 - (A) LOSS OF ONE OF FOUR BULKHEAD LATCHES.
 - (B) DOOR TO AIRFRAME STRUCTURAL INTEGRITY DEGRADED.
 - (C) ENTRY MAY PROCEED WITH ANY SINGLE LATCH DISENGAGED, REF. JSC08934.
 - (D) POSSIBLE LOSS OF CREW/VEHICLE IF MORE THAN ONE GANG OF BULKHEAD LATCHES FAIL TO LATCH.

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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. LINKAGE IS DESIGNED WITH POSITIVE MARGINS OF SAFETY UP TO THE FOLLOWING POSITIONS FROM ON CENTER: FORWARD BULKHEAD LATCH 1 - 26 DEGREES; LATCH 2 - 14.5 DEGREES; LATCH 3 - 9 DEGREES; LATCH 4 - 6.5 DEGREES. AFT BULKHEAD LATCH 1 - 13 DEGREES; LATCH 2 - 10 DEGREES; LATCH 3 - 7.5 DEGREES; LATCH 4 - 6 DEGREES. ALL MECHANISMS DESIGNED WITH DUAL LOCKING DEVICES ON PIVOT SHAFTS. DESIGN OF THE ACTUATION SYSTEM PERMITS PARTIAL WORKAROUND OF THIS FAILURE MODE BY EXTRAVEHICULAR ACTIVITY (EVA) CREW IF PAYLOAD DOES NOT LIMIT ACCESS.

(B) TEST

QUALIFICATION TESTS: THE QUALIFICATION ACTUATOR IS CERTIFIED PER CR-29-287-0039-0001D (REF. FMEA/CIL 02-4B-007-3). THE PBD 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 (087) INCLUDED: ACCEPTANCE - TO CONFIRM ALL COMPONENTS HAVE BEEN ASSEMBLED AND RIGGED PER ML0308-0022; THERMAL CYCLE TEST - 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; AND 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 FWD 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.

QUAL TESTS ALSO INCLUDE: 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 BULKHEAD AND SILL LONGERONS; 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.

OMRSD: GROUND TURNAROUND INCLUDES VISUAL INSPECTION OF HARDWARE TO INSURE THAT PARTS ARE NOT BROKEN OR DEFORMED AND MONITORING FUNCTIONAL TEST FOR EVIDENCE OF BINDING OR JAMMING.

(C) INSPECTION

RECEIVING INSPECTION

RECEIVING INSPECTION VERIFIES MATERIAL AND PROCESS CERTIFICATIONS.

CONTAMINATION CONTROL

CORROSION PROTECTION IS VERIFIED BY INSPECTION. INSPECTION VERIFIES CLEANLINESS LEVEL MAINTAINED PER MA0110-311.

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ASSEMBLY/INSTALLATION

BEARING AND BUSHING INSTALLATION VERIFIED BY INSPECTION. MACHINED TOLERANCES VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION VERIFIED BY INSPECTION.

TESTING

ACCEPTANCE TESTING VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING AND PACKAGING 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

LATCH TOOLS ARE AVAILABLE FOR EVA WORKAROUND EXCEPT IN THE CASE OF CERTAIN PAYLOADS WHICH LIMIT ACCESS. ABORT DECISION REQUIRED IF DOOR(S) CANNOT BE OPENED.