

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTUATION MECH-PBD FMEA NO 02-4B -113 -2 REV:03/08/88

ASSEMBLY :LATCH MECHANISM CRIT. FUNC: 1R
P/N RI :V070-594306 CRIT. HDW: 2
P/N VENDOR: VEHICLE 102 103 104
QUANTITY :16 EFFECTIVITY: X X X
:1 PER EACH CENTERLINE PHASE(S): PL LO OO X DO LS
LATCH ASSEMBLY

REDUNDANCY SCREEN: A-PASS B-N/A C-PASS
PREPARED BY: APPROVED BY: APPROVED BY (NASA):
DES M. A. ALLEN DES *L. Campbell* SSM *R.C. Martin 3/18/88*
REL M. B. MOSKOWITZ REL *M.B. Moskowitz* REL *W.J. Smith*
QE W. J. SMITH QE *W.J. Smith* QE *W.J. Smith*

ITEM:
HOOK, LATCH ASSEMBLY, CENTERLINE

FUNCTION:
HOOKS TO RETAINING CENTERLINE MECHANISMS.

FAILURE MODE:
STRUCTURAL FAILURE

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

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

(A) LOSS OF ONE CENTERLINE LATCH.

(B) DEGRADED STRUCTURAL INTEGRITY OF FUSELAGE.

(C) ENTRY MAY PROCEED WITH SINGLE CENTERLINE LATCH DISENGAGED, REF. JSC08934.

(D) POSSIBLE LOSS OF CREW/VEHICLE IF MORE THAN ONE CENTERLINE LATCH FAILS 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. HOOK DESIGNED FOR ALL FLIGHT LOADS AND ACTUATOR STALL CONDITION. HOOK STRENGTH VERIFIED BY FRACTURE MECHANICS ANALYSIS. LATCH MECHANISM HOOK REACH CAPABILITY EXCEEDS MAXIMUM PREDICTED ROLLER DISTANCE FOR WORST CASE THERMAL CONDITION (TAIL SUN). Y-Z ALIGNMENT ROLLERS ENSURE PROPER CAPTURE ENVELOPE FOR DOOR OVERLAP CASE. ALL MECHANISMS 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 IF PAYLOAD DOES NOT LIMIT ACCESS.

(B) TEST

QUALIFICATION TESTS: THE ACTUATOR IS CERTIFIED PER CR-28-287-0040-0001H (REF. FMEA/CIL NO. 02-4B-005-1). THE PAYLOAD BAY DOOR LATCHING MECHANISM IS CERTIFIED PER CR-29-594360-001E FOR CENTERLINE LATCH MECHANISM. SYSTEM QUALIFICATION TEST ON 15 FOOT PAYLOAD BAY DOOR TEST ARTICLES (087) INCLUDED: ACCEPTANCE TO CONFORM ALL COMPONENTS HAVE BEEN ASSEMBLED AND RIGGED PER MLO308-0022. ORBITAL FUNCTIONS 3 THERMAL CONDITIONS WITH SIMULATED THERMAL DISTORTIONS OF BULKHEADS AND SILL LONGERONS AND ONE CENTERLINE OVERLAP AND ONE CENTERLINE GAP TEST. OPERATIONAL LIFE TESTS A TOTAL OF 360 CYCLES WERE CONDUCTED ON THE FORWARD AND 334 CYCLES WERE CONDUCTED ON THE AFT CENTERLINE LATCHES. ACOUSTIC TESTS PER MF0004-014C SPEC. CERTIFICATION BY ANALYSIS/SIMILARITY HUMIDITY, FUNGUS, OZONE, PACKAGING, THERMAL VACUUM, SALT SPRAY, SAND/DUST, SHOCK-BASIC DESIGN ULTIMATE LOADS, ACCELERATION, MARGIN OF SAFETY AND MISSION ACOUSTIC LIFE.

ACCEPTANCE TESTS: THE CENTERLINE LATCHING MECHANISMS WERE RIGGED PER CONTROLLED SPECIFICATION MLO308-0022. OPERATION OF LATCHES ARE VERIFIED DURING CHECKOUT AT KSC WHICH INCLUDES PAYLOAD BAY DOOR FUNCTIONAL AND FINAL CHECKOUT PRIOR TO FLIGHT.

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 PER MA0608-301 VERIFIED BY INSPECTION. CLEANLINESS VERIFIED BY INSPECTION

ASSEMBLY/INSTALLATION

MATERIAL MACHINE TOLERANCES VERIFIED BY INSPECTION. INSTALLATION VERIFIED BY INSPECTION. RIGGING AND ALIGNMENT VERIFIED BY INSPECTION. PROCESSING MATERIALS IN CONTACT WITH TITANIUM PER MF0004-018 VERIFIED BY INSPECTION.

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NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION OF HOOK PER MT0501-504 VERIFIED BY INSPECTION.

CRITICAL PROCESSES

APPLICATION OF DRY FILM LUBRICANT PER LB0140-004 VERIFIED BY INSPECTION.

TESTING

ACCEPTANCE TESTING IS 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

LATCH TOOLS ARE AVAILABLE FOR EVA WORKAROUND EXCEPT IN THE CASE OF CERTAIN PAYLOADS WHICH LIMIT ACCESS.