SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTUATION MECH-PBD FMEA NO 02-4B -113 -1 REV:03/08/88

ASSEMBLY :LATCH MECHANISM
P/N RI :V070-594306
P/N VENDOR:
QUANTITY :16
:1 PER EACH CENTERLINE LATCH ASSEMBLY

CRIT. FUNC: 1R
CRIT. HDW: 2

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

REDUNDANCY SCREEN: A-PASS B-FAIL C-PASS

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ITEM:
HOOK, LATCH ASSEMBLY, CENTERLINE

FUNCTION:
HOOKS TO RETAINING CENTERLINE MECHANISMS.

FAILURE MODE:
FAILS TO ENGAGE

CAUSE(S):
ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, FAILURE/DEFLECTION OF INTERNAL PART, IMPROPER RIGGING/ADJUSTMENT, TEMPERATURE

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

(A) LOSS OF FUNCTION - UNABLE TO CLOSE AND LATCH THE CENTERLINE LATCHES.

(B) REDUCTION IN FUSELAGE STRUCTURAL INTEGRITY.

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

(D) FOR LATCH OUT CAPABILITY WITH ONE PAIR DISENGAGED, REFER TO JSC08934. NO EFFECT ON VEHICLE OR CREW WITH SINGLE LATCH OUT. POSSIBLE LOSS OF CREW VEHICLE IF MORE THEN ONE CENTERLINE LATCH FAILS TO ENGAGE.

FAILS REDUNDANCY SCREEN "B" SINCE THE INDICATION SWITCHES INDICATE ALL LATCH HOOKS ARE ENGAGED WITH THE ROLLERS ON THE CENTERLINE LATCH ASSEMBLY ONLY WHEN THE ACTUATOR HAS COMPLETED ITS TRAVEL, REGARDLESS IF ONE OR MORE LATCHES ARE NOT ENGAGED.

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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. LATCH MECHANISM DESIGNED FOR ACTUATOR STALL CONDITION AT MAXIMUM REACH TO 10 DEGREES FROM ON-CENTER POSITION. 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 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 REQUIREMENTS 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 BY INSPECTION.

(D) FAILURE HISTORY

CAR NO. AB4639 : EXCESSIVE TORQUE WAS REQUIRED TO ROTATE ONE OF FOUR CENTERLINE LATCHES IN LATCH GANG ON FORWARD PAYLOAD BAY DOOR TEST ARTICLE IN PRE-QUALIFICATION FUNCTIONAL CHECK; FAILURE CAUSED BY PRESENCE OF A PLASTIC FILM (LOCTITE) ON THE AFT BUSHING PLUS THE NUMBER OF CYCLES (30); LATCH WAS REDRYFILM LUBED AND BUSHINGS WERE SOLVENT CLEANED PRIOR TO RE-ASSEMBLY.

(E) OPERATIONAL USE
THERMAL CONDITIONING OF VEHICLE CAN BE DONE TO ATTEMPT TO ALLEVIATE PROBLEM. 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.