SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTUATION MECH-HATCHES FMEA NO 02-4A -593201 -1 REV:10/27/87

ASSEMBLY :HATCH, INGRESS/EGRESS
P/N RI :V070-593201
P/N VENDOR:
QUANTITY :1

CRIT. FUNC: 1
CRIT. HDW: 1

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X

PHASE(S): PL X LO OO DO LS

REDUNDANCY SCREEN: A- B- C-

PREPARED BY:
DES R. H. YEE
REL M. B. MOSKOWITZ
QE J. BARKER

APPROVED BY:
DES R. H. Yee for A. G. Ordonez SSM
REL
QE

APPROVED BY (NASA):

ITEM:
LATCH MECHANISM, INGRESS/EGRESS HATCH

FUNCTION:
THIS ASSEMBLY CONSISTS OF EIGHTEEN (18) APOLLO CM PROVEN HATCH-TYPE LATCHES WHICH ARE JOINED BY RODS. THE RODS MOVE CIRCUMFERENTIALLY, CAUSING THE LATCHES TO MOVE AXIALLY SECURING THE HATCH IN A CLOSED POSITION. TWO LATCHES INCORPORATE PROVISION FOR "BREAKING" THE HATCH SEALS AGAINST ANY SMALL RESIDUAL DELTA PRESSURE WHEN OPENING THE HATCH. LATCHES ARE DRIVEN BY A MANUALLY OPERATED REDUCTION GEARBOX (ACTUATOR).

FAILURE MODE:
FAILS TO DISENGAGE

CAUSE(S):
ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, FAILURE/DEFLECTION OF INTERNAL PART, PHYSICAL BINDING/JAMMING

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

(A) LOSS OF FUNCTION DUE TO INABILITY TO INGRESS OR EGRESS ORBITER THROUGH SIDE HATCH. INABILITY TO CLOSE OUT CREW MODULE FOR FLIGHT.

(B) NO EFFECT. FAILURE TO OPEN SIDE HATCH DOES NOT AFFECT INTERFACING SYSTEMS.

(C,D) POSSIBLE LOSS OF MISSION OBJECTIVES AND CREW IF FAILURE OCCURS WHEN EMERGENCY EGRESS ON THE PAD IS REQUIRED (OVERHEAD EMERGENCY EGRESS WINDOW IS NOT USABLE ON THE PAD; ONLY AFTER A LANDING). NO EFFECT IN FLIGHT. TOOLS ARE AVAILABLE TO DISCONNECT AND TO DRIVE THE LATCHES OPEN FOR A NON-EMERGENCY EGRESS IF TIME IS AVAILABLE. IF FAILURE OCCURS DURING A POST-LANDING EMERGENCY, THE OVERHEAD EMERGENCY EGRESS WINDOW OR PYROTECHNIC SIDE HATCH CREW ESCAPE SYSTEM CAN BE UTILIZED.

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DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A) DESIGN
LATCH MECHANISM BASED ON PROVEN APOLLO DESIGN, LINKAGE ATTACHMENTS HAVE DUAL ROTATING SURFACES, MAXIMUM UNLATCHING FORCE IS 30 LB AT THE ACTUATOR HANDLE, ACTUATOR AND LINKAGE DESIGNED FOR 150 LB LIMIT LOAD (AT THE HANDLE), POSITIVE MARGINS ON ALL COMPONENTS, PROTECTIVE COVER MINIMIZES CONTAMINATION, SEAL COMPRESSIVE FORCE ASSISTS UNLATCHING, LATCH AND LINKAGE MATERIALS, INCONEL, A286 CRES, BERYLLIUM COPPER, CHOSEN FOR HIGH STRENGTH AND LOW WEAR, DRY FILM LUBE ON BEARING SURFACES. DESIGN STRESS ANALYSIS REPORT SD77-SH-0178, VOL. 6.

(B) TEST
QUALIFICATION TESTS: QUALIFICATION OF THE LATCH MECHANISM WERE SUCCESSFULLY COMPLETED AS PART OF THE HATCH SYSTEM QUALIFICATION (PER CR-28-593201-001C) AND INCLUDED ENVIRONMENT REQUIREMENTS AND TEST CRITERIA PER MF0004-14 (FUNGUS, OZONE, SAND/DUST, TEMPERATURE CYCLE, CRASH SHOCK, STRUCTURE LIMIT LOAD, AND ACCELERATION WERE CERTIFIED BY ANALYSIS). QUALIFICATION TESTS INCLUDED: PROOF PRESSURE TEST OF LATCHED HATCH AT 17.7 PSIG FOR 2.0 +/- 1.0 MINUTE (PER ML0206-0016), CABIN ATMOSPHERE (PER MIL-STD-810B, FOR 1 HOUR), HUMIDITY AT 85% RELATIVE HUMIDITY FOR 120 HOURS (THERMALLY CYCLED 4 TIMES BETWEEN 60 DEG F AND 125 DEG F, EVERY 24 HOURS), LIFE CYCLE TEST (1,000 CYCLES WITH HATCH IN VERTICAL POSITION, 1,000 CYCLES WITH HATCH IN HORIZONTAL POSITION, SEAL LEAK TEST AT 15 +/- 0.1 PSID EVERY 500 CYCLES, LATCHING FORCE AT ACTUATOR HANDLE 50 LB MAXIMUM AND UNLATCHING FORCE AT ACTUATOR HANDLE 30 LB MAXIMUM) AND VIBRATION TEST (RANDOM VIBRATION - NORMAL TO HATCH FOR 48 MINUTES). ACTUATOR ALSO COMPONENT QUALIFIED PER CR-28-287-0036-0006C. LATCH MECHANISM INSTALLED AND RIGGED PER SPECIFICATION ML0308-0003.

OMRSD: VISUALLY INSPECT OPENING OF CABIN HATCH FROM OUTSIDE-HORIZONTAL, INSIDE-HORIZONTAL, AND INSIDE-VERTICAL.

(C) INSPECTION

RECEIVING INSPECTION
SUPPLIER HARDWARE INSPECTED IN ACCORDANCE WITH QUALITY PLANNING REQUIREMENTS DOCUMENT (QPRD).

CONTAMINATION CONTROL
CORROSION PROTECTION PROCESSES ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
ALL DETAIL HARDWARE IS VERIFIED BY INSPECTION AT THE DETAIL LEVEL. INSPECTION VERIFICATION IS REVERIFIED PRIOR TO ASSEMBLY. ALL LATCHES ARE INSTALLED AND SYSTEMATICALLY TORQUED AND VERIFIED BY INSPECTION. ALL FASTENER TORQUES ARE VERIFIED BY INSPECTION. PEAK TORQUE (35 INCH-LB) AT EACH LATCH BELLCRANK IS MEASURED DURING INSTALLATION AND VERIFIED BY INSPECTION. ALL INSTALLATIONS, ADJUSTMENTS, AND RIGGING OF MECHANICAL UNITS ARE VERIFIED BY INSPECTION. O-RINGS ARE MAGNIFICATION INSPECTED PRIOR TO INSTALLATION.

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NONDESTRUCTIVE EVALUATION
STRUCTURAL INTEGRITY VERIFIED BY NONDESTRUCTIVE EVALUATION (NDE) (X-RAY).

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

(E) OPERATIONAL USE
CREW CAN MANUALLY DISCONNECT AND THEN DRIVE THE LATCHES (WITH AVAILABLE TOOLS) TO EXIT THE CABIN IF A FAILURE OCCURS ON THE PAD OR AFTER A NON-EMERGENCY LANDING. THE OVERHEAD EMERGENCY EGRESS WINDOW MAY BE USED BY CREWMEMBERS OR GROUND PERSONNEL ONLY AFTER AN EMERGENCY LANDING. THE EMERGENCY (PYROTECHNIC) SIDE HATCH CREW ESCAPE SYSTEM WILL BE INSTALLED FOR STS-26.