

PRINT DATE: 12/20/88

TITLE CRITICAL ITEMS LIST - GREITER

NUMBER: 02-4A-593301-X

SUBSYSTEM NAME: PERSONNEL HATCHES

REVISION : 0 12/20/88 W

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	LATCH MECHANISM, AIRLOCK HATCH	V075-593301

QUANTITY OF LIKE ITEMS: 2

DESCRIPTION/FUNCTION:

THIS MECHANISM IS MOUNTED ON BOTH AIRLOCK HATCHES "A" AND "B" TO SECURE EACH HATCH IN THE CLOSED AND SEALED POSITION. THIS MECHANISM CONSISTS OF MECHANICAL LINKS, BELLCRANKS, LATCHES AND ATTACHMENTS. THIS MECHANISM IS DRIVEN BY A MANUALLY OPERATED REDUCTION GEARBOX (ACTUATOR) AND UTILIZES 6 APOLLO CREW MODULE-TYPE LATCHES. THREE "KICKER" LATCHES ON HATCH "A" AND TWO "KICKER" LATCHES ON HATCH "B" INCORPORATE PROVISION FOR "BREAKING" THE HATCH SEALS AGAINST ANY SMALL RESIDUAL DELTA PRESSURE WHEN OPENING THE HATCHES.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 02-4A-593301-X

SUMMARY

SUBSYSTEM NAME: PERSONNEL MATCHES
 LRU LATCH MECHANISM, AIRLOCK HATCH
 LRU PART #: V075-593301
 ITEM NAME: LATCH MECHANISM, AIRLOCK HATCH

FMEA NUMBER	ABBREVIATED FAILURE MODE DESCRIPTION	CIL FLG	CRIT	RED FLG
02-4A-593301-01	FAILS TO DISENGAGE*	X	2 2	
02-4A-593301-02	FAILS TO ENGAGE*	X	1 1	

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 02-4A-593301-02

SUBSYSTEM: PERSONNEL HATCHES REVISION: 0 12/20/86 W
 LRU LATCH MECHANISM, AIRLOCK HATCH
 ITEM NAME: LATCH MECHANISM, AIRLOCK HATCH CRITICALITY OF THIS
 FAILURE MODE: 1 1

FAILS TO ENGAGE

MISSION PHASE:
 00 ON-ORBIT

VEHICLE/PAYLOAD/RIT EFFECTIVITY:	102	COLUMBIA
	: 103	DISCOVERY
	: 104	ATLANTIS

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

CRITICALITY 1/1 DURING INTACT ABORT ONLY? Y
 00

REDUNDANCY SCREEN A) PASS
 B) PASS
 C) PASS

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
 LOSS OF POSITIVE HATCH CLOSURE CAPABILITY.

(B) INTERFACING SUBSYSTEM(S):
 LOSS OF OR DEGRADED CAPABILITY TO DE-PRESSURIZE OR RE-PRESSURIZE
 AIRLOCK.

(C) MISSION:
 LOSS OF EXTRAVEHICULAR ACTIVITY (EVA) CAPABILITY IF HATCH "A" LATCHES
 FAIL TO ENGAGE. POSSIBLE LOSS OF CREWMEMBER IF HATCH "B" CANNOT BE
 CLOSED AND SEALED; THUS PREVENTING REPRESSURIZATION OF AIRLOCK.

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(D) CREW, VEHICLE, AND ELEMENT(S):
SAME AS (C)

(E) FUNCTIONAL CRITICALITY EFFECTS

- DISPOSITION RATIONALE -

(A) DESIGN:

LATCH MECHANISM BASED ON PROVEN APOLLO DESIGN, LINKAGE ATTACHMENTS HAVE DUAL ROTATING SURFACES, POSITIVE MARGINS ON ALL COMPONENTS, PROTECTIVE COVER MINIMIZES CONTAMINATION. MAXIMUM LATCHING 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. LATCH AND LINKAGE MATERIALS (INCONEL, A286 CRES, BERYLLIUM COPPER) CHOSEN FOR HIGH STRENGTH AND LOW WEAR. DRY FILM LUBE ON BEARING SURFACES. DIFFERENTIAL PRESSURE IN HATCH CLOSING DIRECTION. DESIGN STRESS ANALYSIS REPORT SD77-SH-0178, VOL. 6.

(B) TEST:

QUALIFICATION TESTS: LATCHES AND ACTUATOR SYSTEM QUALIFIED BY SIMILARITY (PER CR-28-593201-001C) TO THE MECHANISMS ON THE INGRESS/EGRESS HATCH. REFERENCE FMEA/CIL 02-4A-593201-01. ACTUATOR ALSO COMPONENT QUALIFIED BY SIMILARITY TO ACTUATOR ON INGRESS/EGRESS HATCH (PER CR-28-287-0036-0006C); REFERENCE FMEA/CIL 02-4A-593202-01. CERTIFICATION BY SIMILARITY INCLUDED: FUNGUS, SALT/FOG, OZONE, SAND/DUST, TEMPERATURE CYCLE, CRASH/SHOCK, ACCELERATION, CABIN ATMOSPHERE, LIFE CYCLE (2,000 CYCLES), VIBRATION AND STRUCTURAL LOAD REQUIREMENTS.

CERTIFICATION TESTS INCLUDED: ZERO-"G" AND ONE-"G" OPERATION (USING APPROPRIATE GSE EQUIPMENT) AND HATCH SEALING/LEAK TEST (WITH 15.0 PSID ACROSS HIGH-PRESSURE SIDE OF HATCH, WITH MAXIMUM ALLOWABLE LEAK RATE OF 1.03 SCIM), PROOF PRESSURE 17.7 PSID FOR 2.0 +/- 1.0 MINUTE (PER MLO206-0089). LATCH MECHANISM INSTALLED AND RIGGED PER TECH ORDER INSTALLATION M072-593301.

OMRSD: MECHANISM IS FUNCTIONALLY OPERATED FOR EVIDENCE OF BINDING, SURFACE CONTAMINATION AND POSSIBLE DAMAGE. VISUALLY INSPECT AIRLOCK HATCH "A" OPERATIONS CABIN/AIRLOCK SIDE AND AIRLOCK HATCH "B" OPERATIONS ON AIRLOCK SIDE EVERY FLIGHT. HATCH "B" FUNCTIONALS FROM THE PAYLOAD BAY SIDE ARE PERFORMED FIRST FLIGHT AND LRU RETEST. ALL ACTUATORS AND LATCH MECHANISM COMPONENTS ARE TESTED BY PERFORMING FUNCTIONALS FROM EITHER SIDE OF HATCHES.

(C) INSPECTION:

RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATIONS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

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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 (PER MLO308-0003) ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION OF DETAIL HARDWARE IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

DRY FILM LUBRICATION VERIFIED BY INSPECTION.

TESTING

FUNCTIONAL TESTING VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

CAR NO. AB3854 : DURING VISUAL INSPECTION OF SIDE HATCH ASSEMBLY AFTER COMPLETION OF LIFE CYCLE TESTS AND QUALIFICATION VIBRATION TEST, TWO SHIMS WERE FOUND TORN AND WRINKLED IN LATCHES NO. 6 AND NO. 7; SHIM DAMAGE RESULTED FROM RADIAL (INWARD) LOADING ON LATCH BELLCRANKS DURING MORE THAN 2,000 CYCLES OF OPENING AND CLOSING THE HATCH; ALL SHIMS ON THE QUALIFICATION TEST HATCH WERE RE-INSPECTED AND REPLACED, BUT NO CORRECTIVE ACTION WAS REQUIRED AS HATCH LATCHING MECHANISM PERFORMANCE WAS NOT AFFECTED.

CAR NO. AB7348 : THERE WERE UNSUCCESSFUL ATTEMPTS TO MOVE HATCH "A" TO THE CLOSED POSITION; INABILITY TO CLOSE HATCH WAS A RESULT OF MISALIGNMENT BETWEEN HINGE STOP ASSEMBLY AND LOWER HINGE ARM DUE TO YIELDING (WHICH WAS ATTRIBUTED TO IMPROPER OPERATION OF THE HATCH HINGE MECHANISM AND APPLICATION OF EXCESSIVE FORCE TO THE GSE COUNTERBALANCE); YIELDED PARTS FROM AIRLOCK HATCH "A" WERE REPLACED AND THE AIRLOCK MECHANISM TECH ORDER INSTALLATION WAS CHANGED TO CLARIFY OPERATION OF HATCHES "A" AND "B" DURING GROUND CHECKOUT.

CAR NO. AB7674 : IN GROUND CHECKOUT OF AIRLOCK HATCH "B" ON OV102, CLOSING OPERATION WAS UNSUCCESSFUL IN FOUR ATTEMPTS; THE KICKER DOG ON THE CENTER LATCH WAS ON THE WRONG SIDE OF THE HATCH SILL WHICH PREVENTED ACTUATION OF LATCHES TO THE LATCHED POSITION (LATCH MECHANISM KINEMATICS ALLOWED THE CENTER LATCH KICKER DOG TO INTERFERE WITH HATCH CLOSING BECAUSE OF HATCH ORIENTATION WITH GSE SUPPORT IN ONE-G ENVIRONMENT); A DECAL WAS ATTACHED TO EACH SIDE OF AIRLOCK HATCHES "A" AND "B" TO INDICATE THE REQUIRED POSITION OF THE LATCH ACTUATOR HANDLE FOR CLOSING THE HATCH.

CAR NO. 26F009 : AIRLOCK HATCH "A" DIFFICULT TO LATCH FOR ENTRY;

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YIELDING OF HINGE MECHANISM PARTS DUE TO OPENING HATCH AFTER SPACELAB FLIGHTS WITHOUT GSE SUPPORT; YIELDED PARTS REPLACED AND HATCH OPERATION REVERIFIED TO INCORPORATE RE-INSPECTION OF HATCH MECHANISMS AFTER EMERGENCY OPERATION WITHOUT GSE PLANNED EMERGENCY OPERATIONS. THEN ALLOW RE-ENTRY INTO THE CABIN THROUGH AIRLOCK HATCH "A".

(E) OPERATIONAL USE:

EVA CREWMEMBER CAN MANUALLY HOLD AIRLOCK HATCH "B" IN THE CLOSED POSITION DURING REPRESSURIZATION OF THE AIRLOCK, UNTIL THE PRESSURE DIFFERENTIAL (OF 3.2 PSI MINIMUM) IS SUFFICIENT TO HOLD AND SEAL THE HATCH IN POSITION AND THEN ALLOW FOR RE-ENTRY INTO THE CABIN THROUGH AIRLOCK HATCH "A".

- APPROVALS -

RELIABILITY ENGINEERING:	M. B. MOSKOWITZ	:	<u>M.B. Moskowitz 12/21/88</u>
DESIGN ENGINEERING	: R. H. YEE	:	<u>R.H. Yee for K.C. O'Neil 12/21/88</u>
QUALITY ENGINEERING	: W. J. SMITH	:	<u>W.J. Smith 12/21/88</u>
NASA RELIABILITY	:	:	<u>W.J. Smith 12/21/88</u>
NASA SUBSYSTEM MANAGER	:	:	<u>K.C. O'Neil 12/21/88</u>
NASA QUALITY ASSURANCE	:	:	<u>W.J. Smith 12/21/88</u>