SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 02-4A-593302-X

SUBSYSTEM NAME: PERSONNEL HATCHES

REVISION : 0 12/13/88 W

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	ACTUATOR, AIRLOCK HATCH LATCH	MC287-0036-0008 ELLANEF A1039A10-8,9
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QUANTITY OF LIKE ITEMS: 2

DESCRIPTION/FUNCTION:
THIS DEVICE IS MOUNTED ON BOTH AIRLOCK HATCHES "A" AND "B" AND IS A SEALED AND MANUALLY DRIVEN REDUCTION GEARBOX THAT PROVIDES A CONTROLLED OUTPUT FOR DRIVING THE LATCH MECHANISM OPEN OR CLOSED. IN SO DOING, IT PROVIDES THE FORCE FOR HATCH SEAL COMPRESSION AS IT PULLS THE SEALING SURFACES TOGETHER. TWO HANDLES FOR OPERATION ARE PROVIDED; ONE IS ON EACH SIDE OF EACH HATCH. A MECHANICAL LOCK AND A "NO-BACK" IS PROVIDED FOR RESTRAINT BETWEEN USES. THE KNOB ON THE HANDLE ON THE PAYLOAD BAY SIDE OF HATCH "B" IS REMOVABLE. THE DESIGN UTILIZES DUAL O-RING SEALS TO PREVENT LEAKAGE OF CABIN/AIR LOCK ATMOSPHERE THROUGH OR PAST THE ACTUATORS.

PRINT DATE: 12/13/88

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SUMMARY

SUBSYSTEM NAME: PERSONNEL HATCHES
LRU ACTUATOR, AIRLOCK HATCH LATCH
LRU PART #: MC287-0036-0008
ITEM NAME: ACTUATOR, AIRLOCK HATCH LATCH

FMEA NUMBER	ABBREVIATED FAILURE MODE DESCRIPTION	CIL FLG	CRIT	HZD FLG
02-4A-593302-01	PHYSICAL BINDING/JAMMING*	X	1 1	
02-4A-593302-02	LEAKAGE*	X	2R3	
02-4A-593302-03	FAILS TO UNLOCK*	X	2 2	

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SUBSYSTEM: PERSONNEL HATCHES
LRU ACTUATOR, AIRLOCK HATCH LATCH
ITEM NAME: ACTUATOR, AIRLOCK HATCH LATCH

CRITICALITY OF THIS FAILURE MODE: 1 1

FAILURE MODE:
PHYSICAL BINDING/JAMMING

MISSION PHASE:
OO ON-ORBIT

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

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

CRITICALITY 1/1 DURING ABORT? Y
OO

REDUNDANCY SCREEN A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF ABILITY TO OPERATE HATCH LATCH MECHANISM.

(B) INTERFACING SUBSYSTEM(S):
LOSS OF ABILITY TO SUPPORT EXTRAVEHICULAR ACTIVITY (EVA) OR PRE-EVA TRANSFERS.

(C) MISSION:
SAME AS (B)

(D) CREW, VEHICLE, AND ELEMENT(S):

POSSIBLE LOSS OF CREW/VEHICLE IF EMERGENCY EVA PROCEDURES ARE REQUIRED AND HATCH "A" OR "B" CANNOT BE OPENED, PRE-EVA. POSSIBLE LOSS OF EVA CREWMEMBER IF FAILURE OCCURS ON HATCH "B" (POST-EVA) AND PREVENTS THE LATCHING AND/OR SEALING OF THE HATCH AND THUS PREVENTS THE REPRESSURIZATION OF AIRLOCK.

(E) FUNCTIONAL CRITICALITY EFFECTS

- DISPOSITION RATIONALE -

(A) DESIGN:
THE LATCH DRIVE ACTUATOR HAS DUAL ROTATING SURFACES. THE ACTUATOR IS DESIGNED FOR A 150 LB FORCE LIMIT LOAD AT THE HANDLE (AND A 1.4 FACTOR OF SAFETY). THE MAXIMUM HANDLE LOAD FOR UNLATCHING IS 20 LB FORCE. THE MAXIMUM HANDLE LOAD FOR LATCHING IS 30 LB FORCE. THE ACTUATOR GEARBOX IS DUAL O-RING SEALED TO PREVENT INTERNAL CONTAMINATION, THE EFFECTS OF HARD VACUUM EXPOSURE (TO THE PLANETARY GEARS, BALL BEARINGS, SHAFTS AND THE "NO-BACK") OR LEAKAGE OF CABIN ATMOSPHERE THROUGH OR PAST THE ACTUATOR. DRY FILM LUBE ON BEARING SURFACES. POSITIVE MARGINS ON ALL COMPONENTS.

(B) TEST:
QUALIFICATION TESTS: ACTUATOR COMPONENT QUALIFIED BY SIMILARITY TO MC287-0036-0004 AND -0006 (PER CR-287-0036-0006C). QUALIFICATION TESTS INCLUDE: VIBRATION FOR 48 MINUTES IN EACH OF 3 ORTHOGONAL AXES, CABIN ATMOSPHERE (PER MIL-STD-810B, INCLUDES: 1 HOUR SALT/FOG, THERMAL/HUMIDITY AT +60 DEG F TO +120 DEG F AT 80% RELATIVE HUMIDITY FOR 120 HOURS), LIMIT LOAD (150 LB AT HANDLE 3,750-4,941 LB AT OUTPUT ARM, 10 CYCLES), THERMAL CYCLE TESTS (INCLUDES: THERMAL-VACUUM AT -65 DEG F AND +275 DEG F FOR 5 OPERATIONAL CYCLES, AT EACH TEMPERATURE), PROOF PRESSURE/LEAK AT 16/16.5 PSI, CRASH/SHOCK AT +/- 20 G'S (FOR 11 MILLI-SECONDS, PER MIL-STD-810B), ACCELERATION (5 G'S IN EACH OF 3 ORTHOGONAL AXES, 5 MINUTES EACH), BACKLASH TESTS (MAXIMUM +/- 1 DEGREE WITH +/- 10 LB ON OUTPUT ARM, AND OPERATING LIFE (2,000 CYCLES) WITH 775 LB AT OUTPUT ARM. "NO-BACK" TEST (4,941 LB AND NO GREATER THAN 2 DEGREES DEFLECTION AT OUTPUT ARM), MECHANICAL STOP TEST (ROTATE HANDLE TO EACH STOP AND APPLY 150 LB, 50 CYCLES WITH NO JAMMING), LOCK CONTROL AND INDICATION TEST (APPLY 150 LB TO LOCKED HANDLE, 10 TIMES, WITH LOCK OPERABLE FROM BOTH HANDLES; APPLY 8-10 LB TO LOCKING-LEVER TO UNLOCK 25 TIMES), MECHANICAL LOCK TEST (APPLY 223 LB TO INPUT LOAD CABLE, WITH NON-REMOVABLE HANDLE FULL CLOCKWISE AND LOCKED).

ACCEPTANCE TEST: ACTUATOR ACCEPTANCE TESTS INCLUDE MECHANICAL LOCK TEST (NO ROTATION WITH 150 LB LIMIT LOAD AT HANDLE), NORMAL LOAD TESTS (10 CYCLES, WITH 30 LB AT HANDLE AND 775-988 LB AT OUTPUT ARM), X-RAY (2 VIEWS, PER MIL-STD-453, FOR FOREIGN OBJECTS/MATERIALS, AND LEAKAGE TEST (MAXIMUM 0.00001 STD CC/SEC/INCH OF SEAL WITH 16 PSID LIMIT).

OMRSD: HATCH LATCH ACTUATOR 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 AIRLOCK SIDE EVERY FLIGHT. HATCH "B" FUNCTIONALS FROM THE PAYLOAD BAY SIDE ARE PERFORMED FIRST FLIGHT AND LRU RETEST. ALL ACTUATOR COMPONENTS AND LATCH MECHANISM COMPONENTS ARE TESTED BY PERFORMING FUNCTIONALS FROM EITHER SIDE OF HATCHES.

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIAL VERIFIED VISUAL INSPECTION/IDENTIFICATION PERFORMED, PARTS PROTECTION VERIFIED. O-RINGS ARE MAGNIFICATION INSPECTED FOR DAMAGE.

CONTAMINATION CONTROL
CONTAMINATION CONTROL PROCESSES AND CORROSION PROTECTION PROVISIONS VERIFIED. ALL PARTS ARE CLEANED TO 300 LEVEL PRIOR TO ASSEMBLY AND VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS VERIFIED BY SHOP TRAVELERS. MANDATORY INSPECTION POINTS (MIPS), LATCH AND HANDLE FORCES, GEARBOX ASSEMBLY, AND BEARING INSTALLATION ARE VERIFIED BY INSPECTION. ALL PURCHASED PART DATA PACKS AND SPRING DIAMETERS AND FORCES ARE VERIFIED BY INSPECTION. O-RINGS ARE MAGNIFICATION INSPECTED PRIOR TO INSTALLATION.

NONDESTRUCTIVE EVALUATION
STRUCTURAL INTEGRITY VERIFIED BY NONDESTRUCTIVE EVALUATION (NDE) TECHNIQUES (X-RAY) AND TECHNICIANS CERTIFIED AND VERIFIED BY INSPECTION.

TESTINGS
GEAR HARDNESS TEST, ACROSS PIN MEASUREMENT (TO FIND MAXIMUM ACTUAL SPACE WIDTH AND MINIMUM ACTUAL TOOTH THICKNESS OF SPLINES), AND REDLINE TEST FOR COMPOSITE ERROR ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PROPERLY MONITORED HANDLING AND STORAGE ENVIRONMENT 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 MECHANISMS (ON A LATCHED HATCH "A") CAN BE DISCONNECTED FROM THE ACTUATOR AND EACH LATCH RELEASED INDIVIDUALLY, USING AVAILABLE TOOLS BY AN EVA CREWMEMBER IN THE AIRLOCK, TO REGAIN ACCESS TO THE CREW CABIN: POST-EVA. HATCH "B" REMAINS OPEN AND UNLATCHED WHILE CREWMEMBERS ARE OUTSIDE THE AIRLOCK DURING EVA. 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 HATCH IN POSITION AN THEN ALLOW RE-ENTRY INTO THE CABIN THROUGH AIRLOCK HATCH "A".

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- APPROVALS -

RELIABILITY ENGINEERING	M. B. MOSKOWITZ	M.B. Moskowitz for A.C. Odom 12/14/88
DESIGN ENGINEERING	R. H. YEE	R.H. Yee for A.C. Odom 12/15/88
QUALITY ENGINEERING	W. J. SMITH	W.J. Smith 12 Dec 88
NASA RELIABILITY		[illegible]
NASA SUBSYSTEM MANAGER		A.C. Odom 12/28/88
NASA QUALITY ASSURANCE		[illegible]