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
LRU	:	ACTUATOR, AIRLOCK HATCH LATCH	MC287-0036-0009 ELLANEF A1039A10-8,9

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

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

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	

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTUATION MECH-HATCHES FMEA NO 02-4A -593302 -2 REV:10/27/87

ASSEMBLY :AIRLOCK HATCHES
P/N RI :MC287-0036-0008,-0009
P/N VENDOR:ELLANEF A1039A10-8,9
QUANTITY :2

CRIT. FUNC: 2R
CRIT. HDW: 3

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

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

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

APPROVED BY:
DES
REL
QE

APPROVED BY (NASA):
SSM
REL
QE

ITEM:
ACTUATOR, LATCH DRIVE SEALS, AIRLOCK HATCH

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. THE DESIGN UTILIZES DUAL O-RING SEALS TO PREVENT LEAKAGE OF CABIN/AIRLOCK ATMOSPHERE THROUGH OR PAST THE ACTUATORS.

FAILURE MODE:
LEAKAGE

CAUSE(S):
AGING/OXIDATION/SUBLIMATION, CONTAMINATION/FOREIGN OBJECT/DEBRIS, DEFECTIVE PART/MATERIAL OR MANUFACTURING DEFECT

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

(A,B,C,D) NO EFFECT IF SINGLE SEAL FAILS. TWO SUCCESSIVE SEAL FAILURES ON BOTH HATCH "A" AND "B" ARE REQUIRED TO RESULT IN THE LOSS OF CABIN ATMOSPHERE THROUGH THE AIRLOCK TO THE OUTSIDE - PRE-EVA. TWO SUCCESSIVE SEAL FAILURES ARE REQUIRED ON HATCH "A" TO RESULT IN THE LOSS OF CABIN ATMOSPHERE THROUGH THE AIRLOCK - DURING EVA (WITH HATCH"B" OPEN). TWO SUCCESSIVE SEAL FAILURES ARE REQUIRED ON HATCH "B" TO RESULT IN THE LOSS OF CABIN/AIRLOCK ATMOSPHERE TO THE OUTSIDE - POST EVA (WITH HATCH "B" CLOSED AND HATCH "A" OPEN). FOLLOWING A SECOND SEAL FAILURE, FLOWRATE WILL BE LOW ENOUGH TO ALLOW SAFE EARLY MISSION OR EVA TERMINATION.

FAILS REDUNDANCY SCREENS "A" AND "B" BECAUSE SEALS CANNOT BE VERIFIED INDIVIDUALLY.

SUBSYSTEM :ACTUATION MECH-HATCHES FMEA NO 02-4A -593302 -2 REV:10/27/87

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

(A) DESIGN
SEALS ARE STANDARD TYPE DUAL O-RING SEALS HELD IN SEPARATE GROOVES AGAINST A ROTATING INPUT SHAFT (LIMITED TO 450 DEG) OR AGAINST A SLIDING LOCKING STEM (LIMITED TO LESS THAN 3/8 INCH STROKE). DESIGNED FOR REPEATED USE - 2,000 CYCLES; EACH ROTATIONAL CYCLE OF THE INPUT SHAFT INCLUDES ONE FULL CLOCKWISE AND ONE FULL COUNTERCLOCKWISE ROTATION WITH A NORMAL 30 LB LOAD AT THE HANDLE (EQUIVALENT TO 10 YEAR, 100 MISSION LIFE) - WITHOUT SCHEDULED SERVICING OR MAINTENANCE. EACH SLIDING CYCLE OF THE LOCKING STEM INCLUDES ONE FULL UN-LOCKING AND ONE FULL LOCKING ACTION OF THE FLIP-OVER LOCKING LEVER.

(B) TEST
QUALIFICATION TESTS: SEALS QUALIFIED AS PART OF COMPONENT QUALIFICATION TESTING OF MC287-0036-0004 AND -0006 LATCH ACTUATOR PER CR-287-0036-0006C. QUALIFICATION TESTS INCLUDE: LIMIT LOAD TEST (10 CYCLES, WITH 3,750-4,941 LB AT OUTPUT ARM AND 150 LB AT HANDLE), CABIN ATMOSPHERE TEST (INCLUDES SALT FOG FOR 1 HOUR, 60 DEG F AND 120 DEG F AT 80% RELATIVE HUMIDITY FOR 120 HOURS), RANDOM VIBRATION TESTING FOR 48 MINUTES IN EACH OF THREE ORTHOGONAL AXES, SHOCK TEST (+/- 20 G'S, 11 MILLISECONDS EACH SHOCK, 110 TOTAL; PER MIL-STD-810), NORMAL OUTPUT TEST (2000 CYCLES WITH 30 LB LOAD AT THE HANDLE; NOMINAL 6 CYCLES PER MISSION AND GROUND TURNAROUND; 600 CYCLES PER 100-MISSION LIFE), THERMAL CYCLE TEST BETWEEN -65 DEG F AND +275 DEG F (5 COMPLETE CYCLES AT EACH EXTREME TEMPERATURE - WITH A MINIMUM TEMPERATURE SOAK OF 60 MINUTES) AND ACCELERATION TEST (+/- 5 G'S IN EACH OF THREE ORTHOGONAL AXES, 5 MINUTES IN EACH AXIS).

ACCEPTANCE TESTS: ACCEPTANCE TESTING INCLUDES 100% EXAMINATION, 100% X-RAY, 100% LEAKAGE TESTING (NOT TO EXCEED 0.00001 STD CC/ SEC/INCH OF SEAL AT 16 PSI LIMIT DELTA P) AND 100% NORMAL LOAD TEST (10 CYCLES, WITH 30 LB AT HANDLE AND 775-988 LB ON OUTPUT ARM).

OMRSD: HATCH LATCH ACTUATOR WILL BE VISUALLY INSPECTED FOR EVIDENCE OF BINDING, SURFACE CONTAMINATION AND POSSIBLE DAMAGE. VISUALLY INSPECT AIRLOCK HATCH "A" OPERATIONS CABIN/AIRLOCK SIDE AND AIRLOCK HATCH "B" OPERATIONS AIRLOCK/PAYLOAD BAY SIDE. NO OMRSD TEST CAPABLE OF DETECTING FIRST FAILURE OF SEAL. MAINTENANCE SAMPLING ON ACTUATOR AND SEALS AFTER FIRST 16 FLIGHTS/8 YEARS AND THEN AFTER NEXT 12 FLIGHTS/2 YEARS.

(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 LEVEL 300 PRIOR TO ASSEMBLY AND VERIFIED BY INSPECTION.

SUBSYSTEM :ACTUATION MECH-HATCHES FMEA NO 02-4A -593302 -2 REV:10/27/87

ASSEMBLY/INSTALLATION
MANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS VERIFIED BY SHOP TRAVELER MANDATORY INSPECTION POINTS (MIPS). O-RINGS ARE MAGNIFICATION INSPECTED PRIOR TO INSTALLATION.

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

STORAGE
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
THE RATE OF LEAKAGE AND THE FEASIBILITY OF COMPLETING THE MISSION OR EVA CAN BE DETERMINED.