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PRINT DATE: 09/18/95

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE
NUMBER: M8-1MR-M004-X

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK
REVISION: 3 9/15/95

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU : ACTUATOR, HATCH LATCH	MC287-0036-0008

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
EXTERNAL AIRLOCK AFT HATCH LATCH ACTUATOR

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 1
ONE

FUNCTION:
MANUALLY DRIVEN REDUCTION GEARBOX - PROVIDES A CONTROLLED OUTPUT FOR DRIVING THE LATCH MECHANISM ON EXTERNAL AIRLOCK AFT HATCH OPEN OR CLOSED. PROVIDES THE FORCE FOR HATCH SEAL COMPRESSION AS IT PULLS THE SEALING SURFACES TOGETHER. TWO HANDLES FOR OPERATION ARE PROVIDED FOR THE HATCH; ONE IS ON EACH SIDE OF THE HATCH. A MECHANICAL LOCK AND A "NO-BACK" ARE PROVIDED FOR RESTRAINT BETWEEN USES. THE KNOB ON THE HANDLE ON THE SPACELAB SIDE (MIR 1) OR PAYLOAD BAY SIDE (MULTI-MIR) OF THE HATCH IS REMOVABLE. THE DESIGN UTILIZES DUAL O-RING SEALS TO PREVENT LEAKAGE OF ODS PRESSURE THROUGH OR PAST THE ACTUATORS.

REFERENCE DOCUMENTS: M072-593628

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FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: M8-1MR-M004-03

REVISIONS 3 9/15/95

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK

LRU: ACTUATOR, HATCH LATCH

ITEM NAME: LOCK MECHANISM

CRITICALITY OF THIS

FAILURE MODE: 2/2

FAILURE MODE:

FAIL TO UNLOCK

MISSION PHASE:

OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 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? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? N/A

REDUNDANCY SCREEN

A) N/A

B) N/A

C) N/A

PASS/FAIL RATIONALE:A)
N/AB)
N/AC)
N/A**METHOD OF FAULT DETECTION:**LATCH ACTUATOR FAILING TO UNLOCK CAN VISUALLY/PHYSICALLY BE DETECTED BY
THE FLIGHT CREW.**REMARKS/RECOMMENDATIONS:**THE ACTUATOR/HANDLE IS NOT NORMALLY IN THE "LOCK" POSITION WHILE THE HATCH
IS OPEN AND UNLATCHED. CRITICALITY OF THIS FAILURE MODE (2/2) ADDRESSES THE
WORST CASE SENARIO OF HAVING A PRESSURIZED PAYLOAD. WHERE AS, THE
CRITICALITY OF THIS FAILURE MODE WITHOUT A PRESSURIZED PAYLOAD IS A 1R3.

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FAILURE MODES EFFECTS ANALYSIS (FMEA) - OIL FAILURE MODE

NUMBER: M8-1MR-M004-03

- FAILURE EFFECTS -

(A) SUBSYSTEM:

A LATCH ACTUATOR FAILING TO UNLOCK WOULD PREVENT THE LATCHES FROM OPERATING AND WILL CAUSE THE LOSS OF CAPABILITY TO OPEN EXTERNAL AIRLOCK AFT HATCH.

(B) INTERFACING SUBSYSTEM(S):

MIR 1 - INABILITY OF CREW TO ENTER SPACELAB. MULTI-MIR - LOSS OF EVA CAPABILITY IF THE HATCH LATCH LOCK MECHANISM FAILS TO UNLOCK THE HANDLE ON EXTERNAL AIRLOCK AFT HATCH PRE-EVA.

(C) MISSION:

MIR 1 - LOSS OF MISSION OBJECTIVES ASSOCIATED WITH SPACELAB IF LATCH LOCK MECHANISM FAILS TO UNLOCK THE HATCH HANDLE AND EXTERNAL AIRLOCK AFT HATCH CANNOT BE OPENED FOR CREW ENTRY INTO SPACELAB.
MULTI-MIR - NO EFFECT ON IVA MISSION OBJECTIVES. LOSS OF PLANNED EVA CAPABILITY OUT EXTERNAL AIRLOCK.

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

MIR 1 - NO EFFECT ON CREW OR VEHICLE.
MULTI-MIR - POSSIBLE LOSS OF CREW/VEHICLE IF EMERGENCY EVA OUT EXTERNAL AIRLOCK IS REQUIRED.

(E) FUNCTIONAL CRITICALITY EFFECTS:

MIR 1 - N/A
MULTI-MIR - A FAILURE TO UNLOCK AND OPEN EXTERNAL AIRLOCK AFT HATCH, FOLLOWING FAILURE TO UTILIZE EVA "C" HATCH, WOULD PRECLUDE EVA CAPABILITIES WHEN ORBITER AND MIR ARE DOCKED. INABILITY TO PERFORM CONTINGENCY EVA TO CORRECT A CRIT 1 CONDITION COULD RESULT IN LOSS OF CREW/VEHICLE. - CRITICALITY 1R3 CONDITION.

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 2/2

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

N/A (THERE ARE NO WORKAROUNDS TO CIRCUMVENT THIS FAILURE).

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: MINUTES

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: N/A

IS TIME REQUIRED TO IMPLEMENT CORRECTIVE ACTION LESS THAN TIME TO EFFECT?
NO

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:

THERE IS NO CORRECTIVE ACTION TO UNLOCK A LOCKED AFT HATCH LATCH ACTUATOR.

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FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

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HAZARDS REPORT NUMBER(S): NONE

HAZARD(S) DESCRIPTION:

N/A

-DISPOSITION RATIONALE-

(A) DESIGN:

THE ACTUATOR HANDLE LOCK PROVIDES A POSITIVE MEANS TO LOCK OR UNLOCK THE LATCH ACTUATOR BY RESTRAINING OR UNDERSTANDING THE HANDLE WITH A SHEAR-PIN THAT IS ACTIVATED PROVIDEDS FLIP-OVER LOCKING-LEVER (LOCATED ON EACH HANDLE). THE LOCKING-LEVER ALSO PROVIDES A VISUAL INDICATION OF THE LOCKED AND UNLOCKED CONDITION OF THE ACTUATOR AND REQUIRES 8-10 LB FORCE (TO OPPOSE A SPRING-LOADED DETENT) TO BE IN PLACE IN THE UNLOCKED POSITION. VIBRATION, BUMPING, KICKING OR OTHER UNINTENTIONAL MEANS SHALL NOT UNLOCK THE ACTUATOR.

(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 INDICATOR 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 TEST INCLUDES MECHANICAL LOCK TEST (NO ROTATION WITH 150 LB LIMIT LOAD AT HANDLE), NORMAL LOAD TESTS (10 CYCLES, WITH 30 LB HANDLE AND 775-888 LB AT 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 - TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION
RAW MATERIAL VERIFIED VISUAL INSPECTION/IDENTIFICATION PERFORMED, PARTS PROTECTION VERIFIED.

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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.

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

TESTING
 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:
 CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN PRACA DATA BASE.

(E) OPERATIONAL USE:
 MIR 1 - NO WORKAROUND IS POSSIBLE IF EXTERNAL AIRLOCK AFT HATCH ACTUATOR FAILS TO UNLOCK PRIOR TO ENTRY TO SPACELAB. EXTERNAL AIRLOCK AFT HATCH REMAINS OPEN DURING SPACELAB OPERATIONS.
 MULTI-MIR- NO OPERATIONAL WORKAROUND IS POSSIBLE IF THE EXTERNAL AIRLOCK AFT HATCH ACTUATOR FAILS TO UNLOCK WHILE ORBITER AND MIR ARE DOCKED. CREW COULD UTILIZE EXTERNAL AIRLOCK UPPER HATCH FOR EVA PURPOSES IF EXTERNAL AIRLOCK AFT HATCH ACTUATOR FAILS TO UNLOCK PRIOR TO OR FOLLOWING MIR DOCKING. FAILURE MODE CANNOT OCCUR ON EXTERNAL AIRLOCK AFT HATCH AFTER OPENING BECAUSE HATCH REMAINS OPEN DURING EVA.

- APPROVALS -

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