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PRINT DATE: 09/18/95

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE

NUMBER: M8-1MR-M018-X

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK

REVISION: 1 9/15/95

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	SEAL, LATCH ACTUATOR TO HATCH	M83248/1-245

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

EXTERNAL AIRLOCK UPPER HATCH LATCH ACTUATOR TO HATCH STRUCTURE SEAL

REFERENCE DESIGNATORS:**QUANTITY OF LIKE ITEMS: 2**

TWO

FUNCTION:

SEALS THE LATCH ACTUATOR TO THE EXTERNAL AIRLOCK UPPER HATCH STRUCTURE TO PREVENT LEAKAGE THROUGH THIS INTERFACE.

REFERENCE DOCUMENTS: M072-593829

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**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: M8-1MR-M018-01**

REVISION# 1 9/15/86

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK
LRU: SEAL, LATCH ACTUATOR TO HATCH STRUCTURE
ITEM NAME: O-RING SEALS
CRITICALITY OF THIS
FAILURE MODE: 1R3

FAILURE MODE:
LEAKAGE

MISSION PHASE:
OO ON-ORBIT

VEHICLE/PAYLOAD/MKIT EFFECTIVITY: 104 ATLANTIS

CAUSE:
AGING/OXIDATION/SUBLIMATION, CONTAMINATION/FOREIGN OBJECT/DEBRIS,
DEFECTIVE PART MATERIAL OR MANUFACTURING DEFECT, INADEQUATE/EXCESSIVE/
UNEVEN SEAL COMPRESSION LOADS, MISHANDLING, THERMAL DISTORTION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

REDUNDANCY SCREEN A) FAIL
 B) N/A
 C) PASS

PASS/FAIL RATIONALE:

A)
FAILS REDUNDANCY SCREEN "A" BECAUSE THE SEALS CANNOT BE VERIFIED
INDIVIDUALLY DURING GROUND CHECKOUT.

B)
N/A - AT LEAST TWO REMAINING PATHS ARE DETECTABLE IN FLIGHT.

C)

METHOD OF FAULT DETECTION:
NONE FOR FIRST FAILURE. FAILURE OF REDUNDANT O-RING SEAL CAN BE DETECTED
THROUGH INSTRUMENTATION & PHYSICAL OBSERVATION - LOSS OF ODS PRESSURE
WHEN ORBITER AND MIR ARE NOT DOCKED.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NO EFFECT FIRST FAILURE. SECOND O-RING FAILURE WILL RESULT IN THE INABILITY
TO ISOLATE THE VESTIBULE TUNNEL FROM EXTERNAL AIRLOCK ENVIRONMENT. NO
EFFECT DURING IVA SINCE EXTERNAL AIRLOCK UPPER HATCH IS OPEN.

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(B) INTERFACING SUBSYSTEM(S):

NO EFFECT FIRST FAILURE. LOSS OF PRESSURE TO OUTSIDE ATMOSPHERE AND INCREASED USE OF O2/N2 CONSUMABLES GIVEN A SIMILAR FAILURE OF SECOND O-RING WHEN ORBITER AND MIR ARE NOT DOCKED. INABILITY TO DEPRESSURIZE VESTIBULE TUNNEL FOR SEPARATION WITHOUT EFFECTING THE AIRLOCK AND TUNNEL ADAPTER VOLUMES.

(C) MISSION:

NO EFFECT FIRST O-RING FAILURE. WORST CASE IF SECOND O-RING FAILURE OCCURS PRIOR TO DOCKING - CREW DECISION TO ABORT MISSION DUE TO LOSS OF CONSUMABLES. NO EFFECT DURING IVA SINCE EXTERNAL AIRLOCK UPPER HATCH IS OPEN.

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

NO EFFECT FIRST FAILURE UNTIL LOSS OF REDUNDANT SEAL AND AN ADDITIONAL SEAL FAILS AND LEAK RATE EXCEEDS MAKEUP CAPABILITY OF ATMOSPHERIC REVITALIZATION PRESSURE CONTROL SYSTEM (ARPCS).

(E) FUNCTIONAL CRITICALITY EFFECTS:

FIRST O-RING FAILURE - NO EFFECT.
 SECOND O-RING FAILURE - POSSIBLE EARLY MISSION TERMINATION DUE TO LEAKAGE TO OUTSIDE ATMOSPHERE WHEN ORBITER/MIR ARE NOT DOCKED RESULTING IN AN INCREASED USE OF CONSUMABLES.
 THIRD FAILURE (ADDITIONAL SINGLE SEAL FAILURE WITHIN HABITABLE VOLUME) - (1) IF THIRD FAILURE OCCURS DURING IVA (CAMERA PREPARATION FOR DOCKING OR SPACELAB OPERATIONS (MIR 1 ONLY)) EXCESSIVE LOSS OF CONSUMABLES CAN JEOPARDIZE CREW SAFETY; (2) IF THIRD FAILURE OCCURS DURING EVA OUT EXTERNAL AIRLOCK, POSSIBLE LOSS OF EVA CREWMEMBERS IF EXTERNAL AIRLOCK VOLUME CANNOT BE REPRESSURIZED FOR RETURN TO CREW CABIN. (EVA CREWMEMBERS MUST REMAIN IN AIRLOCK UNTIL LANDING).

IF SECOND FAILURE OCCURS WHEN ORBITER/MIR ARE DOCKED, POSSIBLE LOSS OF PRESSURE IN MIR IF ISOLATION BETWEEN EXTERNAL AIRLOCK AND MIR IS LOST DURING EVA WHEN EXTERNAL AIRLOCK IS DEPRESSURIZED.

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 1R3

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

FOURTH & FIFTH FAILURE (INABILITY TO CLOSE APPROPRIATE HATCH(S)) - FAILURE TO ISOLATE LEAKAGE FROM CREW CABIN RESULTING IN POTENTIAL LOSS OF CREW AND VEHICLE.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: MINUTES

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: SECONDS TO MINUTES

IS TIME REQUIRED TO IMPLEMENT CORRECTIVE ACTION LESS THAN TIME TO EFFECT?
 YES

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RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
CREW WOULD HAVE SUFFICIENT TIME TO CLOSE APPROPRIATE HATCH(S) TO ISOLATE LEAKAGE FROM THE CREW CABIN VOLUME BEFORE EXCESSIVE LEAKAGE BECAME CATASTROPHIC.

HAZARDS REPORT NUMBER(S): ORBI 511

HAZARD(S) DESCRIPTION:
LOSS OF HABITABLE PRESSURE WHEN ORBITER AND MIR ARE NOT DOCKED.

-DISPOSITION RATIONALE-

(A) DESIGN:

ACTUATOR MOUNTING FLANGE IS INSTALLED ON HATCH BASE STRUCTURE WITH 12 ATTACH BOLTS. DUAL CONCENTRIC O-RING FACE SEALS IN ACTUATOR FLANGE GROOVES ARE ADJACENT TO ATTACH BOLTS. O-RINGS ARE LUBRICATED WITH MB0140-010 TYPE II GREASE PER MA0112-303. EITHER O-RING CAN PREVENT LEAKAGE THROUGH HATCH. FLANGE TO HATCH INTERFACE IS METAL TO METAL CONTACT. SEAL MATERIAL IS FLUOROCARBON ELASTOMER (VITON).

(B) TEST:

ACCEPTANCE TESTS: STRUCTURAL LEAK TEST TO 14.7 PSID IS PERFORMED.

QUALIFICATION TESTS: NO QUALIFICATION TESTS WERE PERFORMED ON THE INDIVIDUAL SEAL. CERTIFICATION IS BASED ON ACCEPTANCE TESTS AND SEAL MATERIALS DATA. QUALIFICATION TESTS OF ACTUATOR INCLUDED LIMIT LOAD TEST (10 CYCLES), 2000 OPERATING CYCLES AT 30 INCH-LB INPUT TORQUE, THERMAL CYCLING BETWEEN -65 DEG F AND +250 DEG F.

OMRSD - TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD

(C) INSPECTION:**RECEIVING INSPECTION**

RECEIVING INSPECTORS INSPECT FOR DAMAGE AND WORKMANSHIP AND VERIFY THAT SEAL IS OF SINGLE PIECE MOLDED CONSTRUCTION. RECEIVING INSPECTORS ALSO CHECK IDENTIFICATION AND WALL CROSS-SECTIONAL DIAMETER ON A S-3 SAMPLING BASIS AND THAT SUPPLIER SUBMITTED REQUIRED REPORTS.

CONTAMINATION CONTROL

RECEIVING INSPECTORS VISUALLY INSPECT SEAL FOR CLEANLINESS. INSPECTORS VERIFY, BEFORE INSTALLATION, THAT THE SEALING SURFACE AND VITON SEAL ARE CLEAN.

ASSEMBLY/INSTALLATION

THE SEALS ARE INSTALLED PER MA0106-328. PRIOR TO INSTALLATION AN INSPECTION IS PERFORMED TO VERIFY THAT THE SEALING SURFACE IS NOT DAMAGED. INSPECTION VERIFIES MB0140-010 TYPE II GREASE WAS APPLIED TO O-RINGS AND O-RING GROOVES PRIOR TO ASSEMBLY PER MA0112-303. INSPECTION VERIFIES DIMENSIONS OF DETAIL PARTS.

TESTING

EXTERNAL AIRLOCK PRESSURE TESTS VERIFIED BY INSPECTION.

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HANDLING/PACKAGING

THE RECEIVING INSPECTORS VERIFY THAT THE SEAL IS INDIVIDUALLY PACKAGED WITH PART NUMBER, MANUFACTURER NAME, COMPOUND NUMBER AND CURE DATE. RECEIVING INSPECTORS ALSO VERIFY THAT THE SEAL IS PACKAGED IN A WAY THAT WILL PROTECT IT DURING STORAGE.

(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:

NONE FOR FIRST O-RING SEAL FAILURE. IF BOTH SEALS FAIL ON EXTERNAL AIRLOCK UPPER HATCH ACTUATOR MOUNTING STRUCTURE PRIOR TO OR FOLLOWING MATING WITH THE MIR, GIVEN SUFFICIENT TIME CREW COULD ISOLATE LEAKAGE BY CLOSING APPROPRIATE HATCH(S).

- APPROVALS -

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