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PRINT DATE: 10/10/95

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE

NUMBER: M8-1MR-E003-X

SUBSYSTEM NAME: ECLSS - VESTIBULE TUNNEL

REVISION: 2 9/15/95

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	VALVE, DEPRESSURIZATION CARLETON TECHNOLOGIES	MC250-0002-0290 2765-0001-01

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
VESTIBULE TUNNEL DEPRESSURIZATION VALVE

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:

PROVIDES REDUNDANT CAPABILITY FOR DEPRESSURIZATION OF VESTIBULE TUNNEL BY VENTING AIR OVERBOARD. EACH VALVE CONTAINS TWO BUTTERFLY VALVES (VENT AND VENT ISOLATION) WHICH WORK IN SERIES TO ALLOW 15-20 LB/MIN OF AIR TO FLOW OUT OF VESTIBULE TUNNEL. VALVE ASSEMBLY IS MOUNTED OUTSIDE VESTIBULE TUNNEL WITH A SINGLE O-RING SEAL.

REFERENCE DOCUMENTS: V076-643003
V076-643027
V076-643028
V076-643030

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FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE

NUMBER: M8-1MR-E003-02

REVISION# 2 9/15/95

SUBSYSTEM NAME: ECLSS - EXTERNAL AIRLOCK

LRU: ASSY. DEPRESSURIZATION VALVE

ITEM NAME: VALVE. DEPRESSURIZATION

CRITICALITY OF THIS

FAILURE MODE: 1R3

FAILURE MODE:

FAILS TO OPEN

MISSION PHASE:

OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

CAUSE:

CORROSION, VIBRATION, MECHANICAL SHOCK

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

REDUNDANCY SCREEN

A) PASS

B) N/A

C) PASS

PASS/FAIL RATIONALE:

A)

B)

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

C)

METHOD OF FAULT DETECTION:

DELTA-P READINGS ACROSS UPPER EXTERNAL AIRLOCK HATCH AND DEPRESS VALVE STATUS ON A7A2 PANEL WOULD DETECT A FAILURE OF A DEPRESS VALVE TO OPEN.

CORRECTING ACTION: 1) EVA MAY BE REQUIRED FOR CREW MEMBERS TO MANUALLY OPEN VALVES. (2) INTERNAL DEPRESSURIZATION OF THE VESTIBULE TUNNEL CAN BE ACCOMPLISHED MANUALLY BY: FIRST, OPENING ONE OR BOTH EQUALIZATION VALVES AT THE EXTERNAL AIRLOCK UPPER HATCH; AND SECOND DEPRESSURIZING EXTERNAL AIRLOCK VOLUME WITH ALL HATCHES CLOSED. FOLLOWING DEPRESSURIZATION EXTERNAL AIRLOCK UPPER HATCH EQUALIZATION VALVE(S) ARE CLOSED AND THE EXTERNAL AIRLOCK REPRESSURIZED. THIS WORKAROUND WOULD DEPEND ON THE AVAILABLE SUPPLY OF CONSUMABLES.

REMARKS/RECOMMENDATIONS:

EXTERNAL AIRLOCK UPPER HATCH IS A "B" TYPE HATCH WHICH CANNOT WITHSTAND A 14.7 NEGATIVE PSID. DURING DOCKED OPERATIONS THE VESTIBULE TUNNEL MUST BE DEPRESSURIZED PRIOR TO DEPRESSURIZING THE EXTERNAL AIRLOCK FOR

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PERFORMING AN EVA OUT THIS HATCH (MULTI-MIR ONLY). VALVE CONTROLS ARE PROVIDED IN THE CREW CABIN.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

NO EFFECT FIRST FAILURE - LOSS OF REDUNDANCY.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT FIRST FAILURE. SECOND VALVE FAILURE - INABILITY TO DEPRESSURIZE VESTIBULE TUNNEL WOULD PRECLUDE EVA CAPABILITIES OUT EXTERNAL AIRLOCK.

(C) MISSION:

NO EFFECT FIRST FAILURE. SECOND VALVE FAILURE - LOSS OF CAPABILITY TO PERFORM AN EVA OUT EXTERNAL AIRLOCK. NO EFFECT ON IVA MISSION OPERATIONS.

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

NO EFFECT FIRST AND SECOND FAILURE. INABILITY TO PERFORM CONTINGENCY EVA COULD RESULT IN LOSS OF CREW AND VEHICLE FOLLOWING FAILURE OF EVA "C" HATCH.

(E) FUNCTIONAL CRITICALITY EFFECTS:

WHEN ORBITER AND MIR ARE DOCKED - FAILURE TO DEPRESSURIZE VESTIBULE TUNNEL FOLLOWING SECOND VALVE FAILURE WOULD PREVENT DEPRESSURIZING EXTERNAL AIRLOCK. SINCE UPPER HATCH CANNOT WITHSTAND A NEGATIVE DELTA PRESSURE. (DEPRESSURIZATION WITH VESTIBULE PRESSURIZED WOULD RESULT IN HATCH LIFTING FROM THE O-RING SEALS AND THEN RESEATING FOLLOWING PRESSURE EQUALIZATION ACROSS HATCH. THIS ACTION COULD RESULT IN DAMAGE TO THE O-RING SEALS AND THUS PRECLUDE REPRESSURIZATION OF EXTERNAL AIRLOCK). INABILITY TO PERFORM AN EVA OUT EXTERNAL AIRLOCK.

SECOND VALVE FAILURE WOULD REQUIRE MIR SEPARATION WITH VESTIBULE TUNNEL PRESSURIZED RESULTING IN POSSIBLE STRUCTURAL DAMAGE TO OR MISALIGNMENT OF THE MIR ANTENNA LOCATED NEAR THE ORBITER/MIR INTERFACE (MIR 1 ONLY).

THIRD FAILURE (FAILURE NECESSITATES AN EVA TO CORRECT A CRIT 1 CONDITION) - POSSIBLE LOSS OF CREW AND VEHICLE - CRITICALITY 1R3 CONDITION.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

NONE. CRITICALITY REMAINS AT 1R3. WORKAROUND TO DEPRESSURIZE VESTIBULE TUNNEL THROUGH THE EXTERNAL AIRLOCK ONLY ADDS ANOTHER LEVEL OF REDUNDANCY TO THIS FAILURE MODE.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: MINUTES TO HOURS

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

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
IN THE EVENT EVA "C" HATCH CANNOT BE OPENED TO PERFORM A CONTINGENCY EVA,
CREW WOULD HAVE ENOUGH TIME TO MANUALLY DEPRESSURIZE VESTIBULE
THROUGH THE EXTERNAL AIRLOCK AND UTILIZE EXTERNAL AIRLOCK AFT HATCH FOR
PERFORMING THE EVA BEFORE THE NEED FOR THE CONTINGENCY EVA BECAME
CATASTROPHIC.

HAZARDS REPORT NUMBER(S): DM10HA06(F)

HAZARD(S) DESCRIPTION:
EVA HAZARD.

- APPROVALS -

PRODUCT ASSURANCE ENGR. : M. W. GUENTHER
DESIGN ENGINEER : K. J. KELLY

[Handwritten signatures]