PRINT DATE: 02/06/98

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER:M8-1SS-E055 -X

SUBSYSTEM NAME: ECLSS - ISS NITROGEN TRANSFER SYSTEM
REVISION: 0 04/08/97

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:PANEL, DOCKING BASE GN2	V076-643038-001
SRU	:VALVE, N2 MANUAL VENT CARLETON TECHNOLOGIES	MC250-0004-0017 1-4-00-51-39

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
DOCKING BASE GN2 PANEL ISS NITROGEN TRANSFER LINE MANUAL VENT VALVE

QUANTITY OF LIKE ITEMS: 1
ONE

FUNCTION:
WITH THE MMU SYS 1 ISOLATION VALVE CLOSED, THE VENT VALVE PROVIDES A MEANS TO RELIEVE THE PRESSURE IN THE ISS NITROGEN TRANSFER LINE FOR STOWAGE OF THE NITROGEN FLEXIBLE LINES. THIS VALVE IS LOCATED ON THE DOCKING BASE GN2 PANEL AND IS MANUALLY OPERATED. VALVE IS NORMALLY CLOSED DURING ISS NITROGEN TRANSFER OPERATIONS.

REFERENCE DOCUMENTS: VS28-643001
V076-643036

FAILURE MODES EFFECTS ANALYSIS FMEA -- NON-CIL FAILURE MODE
NUMBER: M8-1SS-E055-02

REVISION#: 0 04/08/97

SUBSYSTEM NAME: ECLSS - ISS NITROGEN TRANSFER SYSTEM
LRU: DOCKING BASE GN2 PANEL **CRITICALITY OF THIS**
ITEM NAME: VALVE, ISS N2 TRANSFER MANUAL VENT **FAILURE MODE:** 1R3

FAILURE MODE:
EXTERNAL LEAKAGE (GROSS)

MISSION PHASE:
LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:
CORROSION, MECHANICAL SHOCK, EXCESSIVE VIBRATION, MATERIAL DEFECT, SEAL MATERIAL DEGRADATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:
A)

B)
N/A - REDUNDANCY PROVIDED BY WORKAROUNDS ARE IN STANDBY UNTIL REQUIRED.

C)

METHOD OF FAULT DETECTION:
NONE UNTIL AN INTERNAL LEAKAGE OF THE UPSTREAM MANUAL SHUTOFF VALVE AND MMU SYS 1 ISO VALVE OCCUR, THEN NITROGEN LEAKAGE CAN BE DETECTED THROUGH ORBITER INSTRUMENTATION BY A QUANTITY DEPLETION INDICATION ON AFFECTED ORBITER N2 TANK(S). PPO2 DETECTORS WITHIN ORBITER MID DECK COULD ACTIVATED THE CAUTION AND WARNING SYSTEM IF OXYGEN LEVELS WERE REDUCED DUE TO A LONG TERM NITROGEN LEAK. AN INTERNAL LEAK OF N2 THAT WOULD RESULT IN HABITABLE PRESSURE EXCEEDING 15.2 PSIA WOULD SOUND A CLASS II ALARM.

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CORRECTING ACTION: MANUAL

CORRECTING ACTION DESCRIPTION:
NONE FOR FIRST TWO FAILURES. A FLOW RESTRICTOR (ORIFICE) LOCATED IN THE NITROGEN LINE NEAR THE ORBITER INTERFACE WILL REDUCE THE FLOW RATE OF NITROGEN TO 25 +/-1 LBM/HR, IN THE EVENT AN EXTERNAL NITROGEN LEAK OCCURS AFTER THIRD FAILURE. EVEN AFTER FULL DEPLETION OF THE ORBITER NITROGEN SUPPLY, THE CREW CABIN AREA CONTAINS SUFFICIENT NITROGEN FOR CREW SURVIVAL DURING ABORTED MISSION DE-ORBIT AND LANDING PHASES.

REMARKS/RECOMMENDATIONS:
SERIES MANUAL SHUTOFF VALVE AND MMU SYS 1 ISO VALVE PROVIDE REDUNDANCY AGAINST A LEAKAGE CONDITION. VENT VALVE IS ONLY OPENED FOLLOWING ORBITER/ISS NITROGEN TRANSFER OPERATIONS AND REMAINS CLOSED ALL OTHER TIMES.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF NITROGEN FLOW ISOLATION BETWEEN THE UPSTREAM MANUAL SHUTOFF VALVE AND DOWNSTREAM QD.

(B) INTERFACING SUBSYSTEM(S):
NO INITIAL EFFECT SINCE MANUAL SHUTOFF VALVE AND MMU SYS 1 ISO VALVE PROVIDE BACKUP SEALS TO THIS VALVE. GROSS EXTERNAL LEAKAGE OF NITROGEN, FOLLOWING THIRD FAILURE, COULD RESULT IN INADEQUATE ORBITER N2 SUPPLY FOR CREW CABIN AIR MAKEUP, WATER TANKS, AND EXTERNAL AIRLOCK REPRESSURIZATION. POSSIBLE HIGH NITROGEN PRESSURE IN DOCKING BASE AND ISS PMA. HIGH CONCENTRATIONS OF N2 COULD REDUCE THE PERCENT OF OXYGEN BELOW THAT NEEDED FOR HUMAN SURVIVAL.

(C) MISSION:
NO EFFECT UNTIL THE UPSTREAM MANUAL SHUTOFF VALVE AND MMU SYS 1 ISO VALVE INTERNALLY LEAK. THEN INCREASE USE OF N2 COULD RESULT IN EARLY MISSION TERMINATION. LOSS OF MISSION OBJECTIVES ASSOCIATED WITH TRANSFERRING GN2 TO SPACE STATION.

(D) CREW, VEHICLE, AND ELEMENT(S):
INABILITY TO SHUTDOWN LEAKAGE OF N2 WITHIN DOCKING BASE AND PMA DUE TO A FAILURE TO CLOSE UPSTREAM VALVES DURING RESOURCE TRANSFER OR DUE TO AN INTERNAL LEAKAGE CONDITION OF UPSTREAM VALVES DURING NON-RESOURCE TRANSFER OPERATIONS, COULD RESULT IN HIGH LEVELS OF N2 WITHIN THESE AREAS. HIGH CONCENTRATIONS OF N2 COULD POTENTIALLY REDUCE THE

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
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PERCENTAGE OF OXYGEN BELOW THAT NEEDED FOR HUMAN SURVIVAL CAUSING CREW ASPHYXIATION. LOSS OF N2 SUPPLY TO ISS COULD IMPACT SPACE STATION OPERATIONS.

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST FAILURE (VENT VALVE EXTERNALLY LEAKS) - LOSS OF NITROGEN FLOW ISOLATION BETWEEN DOWNSTREAM QD AND UPSTREAM SHUTOFF VALVE.
SECOND FAILURE (DOCKING BASE N2 SHUTOFF VALVE INTERNALLY LEAKS OR FAILS TO CLOSE) - LOSS OF ISOLATION BETWEEN LEAKY RELIEF VALVE AND MMU SYS 1 ISO VALVE. NO EFFECT - LOSS OF REDUNDANCY ONLY.
THIRD FAILURE (MMU SYS 1 ISO VALVE INTERNALLY LEAKS OR FAILS TO CLOSE) - EXTERNAL NITROGEN LEAK PATH EXISTS. INABILITY TO ISOLATE AN EXTERNAL NITROGEN LEAK WOULD RESULT IN PREMATURE DEPLETION OF ORBITER GN2 TANKS. LOSS OF EVA CAPABILITIES DUE TO INABILITY TO REPRESSURIZE EXTERNAL AIRLOCK RESULTING FROM LACK OF CONSUMABLES. CREW WOULD HAVE TO RELY ON CONSUMABLES REMAINING IN CREW CABIN DURING ORBITER'S RETURN TO EARTH. AN UNCONTROLLED EXTERNAL LEAKAGE OF NITROGEN WOULD RESULT IN EARLY MISSION TERMINATION. - CRITICALITY 2R3 CONDITION.

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 2R3

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
FOURTH FAILURE (EXTERNAL LEAKAGE OF CABIN PRESSURE) - LOSS OF CABIN PRESSURE WITH NO N2 MAKEUP CAPABILITY WOULD RESULT IN LOSS OF CREW AND VEHICLE. - CRITICALITY 1R3 CONDITION.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: MINUTES

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

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
CREW WOULD HAVE AMPLE TIME TO SHUT OFF NITROGEN FLOW TO ISS USING THE DOCKING BASE N2 SHUTOFF VALVE OR MMU SYS 1 ISO VALVE BEFORE DEPLETION OF ORBITER NITROGEN SUPPLY BECAME CATASTROPHIC. .

HAZARD REPORT NUMBER(S): ORBI 071, ORBI 406

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1S5-E055-02

HAZARD(S) DESCRIPTION:
INADEQUATE NITROGEN SUPPLY TO MAINTAIN CABIN PRESSURE (ORBI 071). LOSS OF HABITABLE ENVIRONMENT IN THE CREW CABIN/ODS HABITABLE VOLUME DUE TO FLOODING OF VOLUME WITH GASEOUS NITROGEN (ORBI 406).

- APPROVALS -

SS & PAE	:	M. W. GUENTHER	:
DESIGN ENGINEER	:	K. J. KELLY	: