

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE
NUMBER:M5-6SS-0920 -X**

SUBSYSTEM NAME: ISS DOCKING SYSTEM

REVISION: 0 02/27/98

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	:PANEL ML86B	VO70-730382
SRU	:CIRCUIT BREAKER	MC454-0026-2030

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

CIRCUIT BREAKER, 3 AMP - EXTERNAL AIRLOCK STRUCTURAL HEATER CONTROL - ZONES 1, 2, AND 3

REFERENCE DESIGNATORS: 80V73A130CB109
80V73A130CB111

QUANTITY OF LIKE ITEMS: 2
(TWO)

FUNCTION:

CONTROLS POWER TO THE PATCH HEATERS AND PROVIDES OVERLOAD PROTECTION FOR THE ML86B PANEL BUS A(B) FROM THE A3K5 CONTACTOR IN MID PCA 1(2).

REFERENCE DOCUMENTS: 1) VS70-640109, SCHEMATIC DIAGRAM - AIRLOCK ENVIRONMENTAL CONTROL SUBSYSTEM

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

NUMBER: M5-6SS-0920-02

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SUBSYSTEM NAME: ISS DOCKING SYSTEM

LRU: PANEL ML86B

ITEM NAME: CIRCUIT BREAKER

CRITICALITY OF THIS

FAILURE MODE: 1R3

FAILURE MODE:

FAILS CLOSED (FAILS TO OPEN MECHANICALLY)

MISSION PHASE: OO ON-ORBIT

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

CAUSE:

A) STRUCTURAL FAILURE, B) CONTAMINATION, C) VIBRATION, D) MECHANICAL SHOCK, E) PROCESSING ANOMALY

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO

REDUNDANCY SCREEN	A) PASS
	B) PASS
	C) PASS

PASS/FAIL RATIONALE:

A)

B)

C)

METHOD OF FAULT DETECTION:

REVIEW OF HEATER CIRCUIT TELEMETRY DATA.

MASTER MEAS. LIST NUMBERS:	V64S0163E
	V64S0164E

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
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CORRECTING ACTION: MANUAL

**CORRECTING ACTION DESCRIPTION:
CREW CAN DE-ENERGIZE UPSTREAM POWER SOURCES**

- FAILURE EFFECTS -

(A) SUBSYSTEM:

FIRST FAILURE - LOSS OF ABILITY TO MANUALLY DE-ENERGIZE AFFECTED EXTERNAL AIRLOCK HEATER CIRCUITS. CIRCUIT BREAKER IS NORMALLY CLOSED.

(B) INTERFACING SUBSYSTEM(S):

FIRST FAILURE - NO EFFECT

(C) MISSION:

FIRST FAILURE - NO EFFECT

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

FIRST FAILURE - NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECTS:

CASE 1:

POSSIBLE INJURY TO CREW AFTER FIVE FAILURES:

- 1) CIRCUIT BREAKER FAILS TO OPEN (MECHANICALLY) - LOSS OF ABILITY TO OPEN THE CIRCUIT BREAKER MANUALLY TO DE-ENERGIZE THE CIRCUIT.
- 2) ASSOCIATED ZONE 1 OR 2 (UPPER EXTERNAL AIRLOCK) CONTROL THERMOSTAT FAILS CLOSED - LOSS OF ABILITY TO CONTROL THE HEATERS BETWEEN THE SET POINT TEMPERATURES (55 TO 75 DEG. F)
- 3) ASSOCIATED ZONE 1 OR 2 OVER TEMPERATURE THERMOSTAT FAILS CLOSED - LOSS OF ABILITY TO AUTOMATICALLY DE-ENERGIZE CIRCUIT WHEN UPPER SET TEMPERATURE IS REACHED. AFFECTED HEATER FAILS ON.
- 4) ERRONEOUS OUTPUT OF ASSOCIATED TEMPERATURE SENSOR INDICATING LOWER THAN ACTUAL TEMPERATURE WHICH WILL NOT TRIGGER THE FDA ALARM WHEN THE HEATER ZONE TEMPERATURE SENSOR RISES ABOVE 113 DEG. F (UPPER FDA LIMIT). HEAT CONDUCTION TO THE SECOND TEMPERATURE SENSOR MAY NOT BE IN SUFFICIENT TIME TO TRIGGER THE FDA ALARM.
- 5) LOSS OF ABILITY OF GROUND PERSONNEL TO RECEIVE DOWNLINKED TEMPERATURE MEASUREMENT DATA - LOSS OF ABILITY TO DETECT HEATER SYSTEM FAILURES AND INFORM CREW TO PERFORM CORRECTIVE ACTION. POSSIBLE INJURY TO CREW DUE TO BURNS UPON CONTACT WITH STRUCTURE HEATED ABOVE HOT TOUCH TEMPERATURE (113 DEG. F).

CASE 2:

POSSIBLE LOSS OF CREW/VEHICLE AFTER FIVE FAILURES:

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- 1) CIRCUIT BREAKER FAILS TO OPEN (MECHANICALLY) - LOSS OF ABILITY TO OPEN THE CIRCUIT BREAKER TO MANUALLY DE-ENERGIZE THE CIRCUIT.
- 2) ASSOCIATED ZONE 3 CONTROL THERMOSTAT FAILS CLOSED - LOSS OF ABILITY TO CONTROL THE AFFECTED HEATERS BETWEEN THE SET POINT TEMPERATURES (55 TO 75 DEG. F).
- 3) ASSOCIATED ZONE 3 OVER TEMPERATURE THERMOSTAT FAILS CLOSED - LOSS OF ABILITY TO AUTOMATICALLY DE-ENERGIZE THE CIRCUIT WHEN UPPER SET TEMPERATURE IS REACHED. AFFECTED HEATER FAILS ON.
- 4) ERRONEOUS OUTPUT OF TEMPERATURE SENSOR INDICATING LOWER THAN ACTUAL TEMPERATURE WHICH WILL NOT TRIGGER THE FDA ALARM WHEN THE HEATER ZONE 3 TEMPERATURE SENSOR RISES ABOVE 113 DEG. F (UPPER FDA LIMIT).
- 5) LOSS OF ABILITY OF GROUND PERSONNEL TO RECEIVE DOWNLINKED TEMPERATURE MEASUREMENT DATA - LOSS OF ABILITY TO DETECT HEATER SYSTEM FAILURES AND INFORM CREW TO PERFORM CORRECTIVE ACTION. POSSIBLE LOSS OF RUSSIAN AVIONICS ON PALLET DUE TO THE EXCEEDANCE OF THE UPPER CERTIFICATION TEMPERATURE LIMIT (122 DEG. F MAXIMUM DURING OPERATION) RESULTING IN LOSS OF NOMINAL UNDOCKING CAPABILITY.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

ALTHOUGH THE CRITICALITY REMAINS UNCHANGED AFTER WORKAROUNDS CONSIDERATION (ALLOWED PER CR S050107W), THEY ARE PROVIDING ADDITIONAL FAULT TOLERANCE TO THE SYSTEM.

CASE 2:

AFTER THE FIFTH FAILURE, THE CREW WOULD PERFORM IFM TO DRIVE THE HOOK MOTORS. IF THE IFM IS NOT SUCCESSFUL (SIXTH FAILURE), THE CREW WOULD PERFORM EVA TO REMOVE 96 BOLTS FROM THE DOCKING BASE TO CIRCUMVENT THE WORST CASE "DESIGN CRITICALITY" EFFECT. IF UNABLE TO PERFORM EVA (SEVENTH FAILURE), POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF ALL UNDOCKING CAPABILITY.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: HOURS

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: HOURS

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

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:

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DESIGN FAULT TOLERANCE: ASSOCIATED CONTROL THERMOSTAT WILL MAINTAIN TEMPERATURE WITHIN LIMITS WHILE THE OVER TEMPERATURE THERMOSTAT WILL DE-ENERGIZE THE POWER CIRCUIT TO THE HEATERS WHEN THE UPPER SET TEMPERATURE IS REACHED.

HAZARD REPORT NUMBER(S): CASE 1: ORBI 404 (STATUS - OPEN), CASE 2: ORBI 401

HAZARD(S) DESCRIPTION:

CASE 1: IVA CREW HAZARDS DUE TO ISS ODS (CAUSE D - HOT SPOTS).
CASE 2: INABILITY TO SAFELY SEPARATE ORBITER FROM A MATED ELEMENT.

- APPROVALS -

SS&PAE
DESIGN ENGINEERING

: T. K. KIMURA
: C. J. ARROYO

J. Kimura 4-13-98
C. J. Arroyo