

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE
NUMBER: M5-6SS-0922 -X

SUBSYSTEM NAME: ISS DOCKING SYSTEM

REVISION: 0

02/27/98

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
ASSY	:EXTERNAL AIRLOCK	V828-000003
LRU	:HEATER - 28.8 W	ME363-0060-0001
LRU	:HEATER - 52.7 W	ME363-0060-0002

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

HEATER - EXTERNAL AIRLOCK STRUCTURE, 28.8 W - ZONES 1 AND 2; 52.7 W - ZONE 3

REFERENCE DESIGNATORS:

- 40V64HR23
- 40V64HR24
- 40V64HR25
- 40V64HR26
- 40V64HR27
- 40V64HR28
- 40V64HR29
- 40V64HR30
- 40V64HR31
- 40V64HR32

QUANTITY OF LIKE ITEMS: 10
 (TEN)

FUNCTION:

PROVIDES REQUIRED HEAT TO PREVENT CONDENSATION ON EXTERNAL AIRLOCK WALLS, AND PREVENT FLUID IN LINES FROM FREEZING.

REFERENCE DOCUMENTS:

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

FAILURE MODES EFFECTS ANALYSIS FMEA - NON-CIL FAILURE MODE

NUMBER: M5-6SS-0922-01

REVISION#: 0 02/27/98

SUBSYSTEM NAME: ISS DOCKING SYSTEM

LRU: EXTERNAL AIRLOCK

ITEM NAME: HEATER

CRITICALITY OF THIS

FAILURE MODE: 1R3

FAILURE MODE:

FAILS OPEN

MISSION PHASE: OD ON-ORBIT

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

CAUSE:

A) PIECE PART 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:

A FDA ALARM ACTIVATES IF A HEATER CIRCUIT FAILS OFF AND A ZONE TEMPERATURE SENSOR DROPS BELOW THE FDA LOWER TEMPERATURE LIMIT.

MASTER MEAS. LIST NUMBERS:	V64T0135A
	V64T0136A
	V64T0137A

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

**CORRECTING ACTION DESCRIPTION:
CREW WILL ACTIVATE REDUNDANT HEATER CIRCUIT.**

- FAILURE EFFECTS -

(A) SUBSYSTEM:

FIRST FAILURE - LOSS OF ONE HEATER CIRCUIT IN ZONE. REDUNDANT HEATER CIRCUIT IN ZONE CONTROLS TEMPERATURE WITHIN LIMITS.

(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:

POSSIBLE LOSS OF CREW/VEHICLE AFTER THREE FAILURES (WHILE DOCKED TO ISS):

- 1) HEATER ELEMENT FAILS OPEN - LOSS OF HEATING IN THE AFFECTED ZONE. THE ASSOCIATED CIRCUIT BREAKER (A) IS OPENED AND THE REDUNDANT HEATER CIRCUIT BREAKER (B) IS CLOSED TO RESTORE HEATING IN THE AFFECTED ZONE.
- 2) GENERAL PURPOSE RELAY (B) IN REDUNDANT HEATER CIRCUIT FAILS OPEN - LOSS OF POWER TO REDUNDANT HEATERS IN ALL THREE ZONES.
- 3) CIRCUIT BREAKER (A) FAILS OPEN DURING ATTEMPT TO RE-ENERGIZE THE REMAINING INTACT (A) HEATERS RESULTING IN LOSS OF ALL HEATING CAPABILITY. POTENTIAL CONDENSATION ON EXTERNAL AIRLOCK WALLS, AND/OR RUPTURE OF FROZEN WATER LINE (DURING EVA) RESULTS IN WATER IN EXTERNAL AIRLOCK. WATER MIGRATION TO KEEL AREA COULD RENDER RUSSIAN AVIONICS INOPERATIVE, RESULTING IN LOSS OF NOMINAL AND PYROTECHNIC 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.

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AFTER THE THIRD 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 (FOURTH 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:
DESIGN FAULT TOLERANCE: POSSIBLE LOSS OF EXTERNAL AIRLOCK STRUCTURE HEATERS AFTER THREE FAILURES. AFTER THE THIRD FAILURE, THE CREW CAN PERFORM EVA TO REMOVE 96 BOLTS FROM THE DOCKING BASE TO UNDOCK.**

HAZARD REPORT NUMBER(S): ORBI 401

**HAZARD(S) DESCRIPTION:
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*
: *[Signature]*