PRINT DATE: 04/11/98

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE
NUMBER:M5-6SS-0910 -X

SUBSYSTEM NAME: ISS DOCKING SYSTEM

REVISION: 0 02/27/98

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
ASSY	:DOCKING BASE	VO76-000003
LRU	:THERMOSTAT, CONTROL	MC452-0147-0019
LRU	:THERMOSTAT, OVER TEMPERATURE	MC452-0147-0049

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
THERMOSTAT, CONTROL (55 - 75 DEG. F) AND OVER TEMPERATURE (70 - 90 DEG. F) - EXTERNAL AIRLOCK DOCKING BASE HEATER POWER, VESTIBULE, ZONES 1, 2, AND 3

REFERENCE DESIGNATORS:
40V64TS31
40V64TS32
40V64TS33
40V64TS34
40V64TS41
40V64TS42
40V64TS43
40V64TS44
40V64TS45
40V64TS46
40V64TS47
40V64TS48

QUANTITY OF LIKE ITEMS: 12
(SIX - CONTROL, SIX - OVER TEMPERATURE THERMOSTATS)

FUNCTION:
CONNECTS AND DISCONNECTS THE HEATER CIRCUITS IN ORDER TO CONTROL THE DOCKING BASE TEMPERATURE.

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

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ENVIRONMENTAL CONTROL SUBSYSTEM

FAILURE MODES EFFECTS ANALYSIS FMEA – NON-CIL FAILURE MODE
NUMBER: M5-6SS-0910-01

REVISION#: 0 02/27/98

SUBSYSTEM NAME: ISS DOCKING SYSTEM
LRU: DOCKING BASE
ITEM NAME: THERMOSTAT

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS OPEN

MISSION PHASE: OO 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:
REVIEW OF HEATER CIRCUIT TELEMETRY DATA

MASTER MEAS. LIST NUMBERS: V64T0133A
V64T0134A

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 - ONE HEATER CIRCUIT IN AFFECTED ZONE CANNOT BE ENERGIZED.

(B) INTERFACING SUBSYSTEM(S):
FIRST FAILURE - NO EFFECT. REDUNDANT POWER CIRCUIT CONTROLS TEMPERATURE WITHIN LIMITS.

(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:

1) THERMOSTAT IN "A" CIRCUIT FAILS OPEN - ONE HEATER STRING IN AFFECTED ZONE FAILS OFF. 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) HEATER STRINGS RESULTING IN LOSS OF ALL HEATING CAPABILITY. POTENTIAL CONDENSATION ON EXTERNAL AIRLOCK WALLS RESULTS IN WATER IN EXTERNAL AIRLOCK. WATER MIGRATION TO KEEL AREA COULD RENDER RUSSIAN AVIONICS INOPERATIVE AFTER DOCKING, 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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NUMBER: M5-6SS-0910-01

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 VESTIBULE HEATING 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	: T. K. KIMURA	T. Kimura 4-13-98
DESIGN ENGINEERING	: C. J. ARROYO	