

PAGE: 1

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**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE
NUMBER: M5-6SS-8005-X**

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 DEC, 1996

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: ENERGIA POWER PANEL RSC-E	MO621-0087-0009 SLYU.468312.001
SRU	: PUSH BUTTON SWITCH	PKZ-8 (AGO.360.212.TU)

PART DATA

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
PUSH-BUTTON SWITCHES (TWO DOUBLE POLE SWITCHES UNDER A SINGLE COVER
CAP,) TWO POLE, MOMENTARY - APDS "RING IN" COMMAND.**

**REFERENCE DESIGNATORS: 36V73A8A3SB1-87
36V73A8A3SB1-88**

**QUANTITY OF LIKE ITEMS: 2
(TWO)**

**FUNCTION:
PROVIDE THE "RING IN" COMMAND STIMULI TO CLOSE THE APPROPRIATE CONTACTS
IN THE DSCU TO ENABLE THE TRANSMITTAL OF THE "RING IN" COMMAND TO THE
DMCU. THE DMCU ENABLES POWER TO THE RING MOTORS (M4 AND M5) FOR RING
EXTENSION AND RETRACTION FUNCTIONS.**

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: M5-6SS-8005-01

REVISION# 0 DEC, 1996

SUBSYSTEM NAME: E - DOCKING SYSTEM

LRU: MC621-0087-0009

ITEM NAME: PUSH BUTTON SWITCH

CRITICALITY OF THIS

FAILURE MODE: 2R3

FAILURE MODE:

FAILS OPEN (MULTIPLE CONTACTS WITHIN ONE SWITCH)

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, F) THERMAL STRESS

CRITICALITY 1M DURING INTACT ABORT ONLY? NO

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

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

PASS/FAIL RATIONALE:

A)

B)

N/A - AT LEAST ONE REMAINING PATH IS DETECTABLE IN FLIGHT.

C)

REDUNDANT FUNCTIONS ROUTED THROUGH THE SAME CONNECTOR.

METHOD OF FAULT DETECTION:

NONE.

MASTER MEAS. LIST NUMBERS: NONE

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: MS-SSS-8005- 01

- FAILURE EFFECTS -

(A) SUBSYSTEM:

PARTIAL LOSS OF SWITCH CONTROL CAPABILITY FOR THE APDS "RING-IN" COMMAND.

(B) INTERFACING SUBSYSTEM(S):

LOSS OF MANUAL COMMAND REDUNDANCY.

(C) MISSION:

FIRST SWITCH FAILURE - NO EFFECT.

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

NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:SHUTTLE OR PMA1 MECHANISM: POSSIBLE LOSS OF MISSION AFTER ~~TWO~~THREE FAILURES.

~~FIRST FAILURE (AUTOMATIC DOCKING SEQUENCE FAILS) - THE AUTOMATIC DOCKING SEQUENCE IS THE PRIMARY MEANS TO RETRACT THE DOCKING RING. THE AUTOMATIC SEQUENCE WOULD HAVE TO FAIL FIRST BEFORE THE MANUAL "RING IN" COMMAND IS INITIATED.~~

FIRST/SECOND FAILURE (ONE OF TWO ASSOCIATED SWITCHES FAILS) - DISABLES ONE OF THREE PANEL COMMAND SIGNALS. NO EFFECT. DEGRADED MANUAL COMMAND REDUNDANCY.

SECOND/THIRD FAILURE (SECOND ASSOCIATED SWITCH FAILS OPEN) - LOSS OF REMAINING TWO PANEL COMMAND CHANNEL INPUTS TO THE DSCU. ~~PARTIAL LOSS OF RING RETRACTION CAPABILITY.~~ LOSS OF CAPABILITY TO SUPPLY THE "RING IN" COMMAND TO THE DMCU. LOSS OF ALL RING CONTROL RESULTING IN LOSS OF CAPABILITY TO PERFORM DOCKING. LOSS OF MISSION OBJECTIVES WITH INABILITY TO PERFORM DOCKING.

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

(F) RATIONALE FOR CRITICALITY CATEGORY DOWNGRADE:

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

AFTER ~~SECOND~~THIRD FAILURE, CREW COULD PERFORM AN IN-FLIGHT MAINTENANCE TO DRIVE THE RING MOTORS DIRECTLY FROM THE FEED-THROUGH CONNECTORS IN THE EXTERNAL AIRLOCK, USING THE ORBITER BREAKOUT BOX. IF UNABLE TO PERFORM THE IFM (~~THIRD~~FOURTH FAILURE), LOSS OF DOCKING CAPABILITY RESULTING IN LOSS OF MISSION OBJECTIVE.

FOR THE SHUTTLE -HARD- MECHANISM, AFTER THE SECOND FAILURE, THE CREW WILL DEPRESS THE -RING OUT- SWITCH AND UTILIZE THE AUTOMATIC SEQUENCE TO COMPLETE DOCKING. IF AUTO SEQUENCE FAILS, THE ABOVE IFM WOULD BE PERFORMED.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
 NUMBER: M5-6SS-8005- 01

-DISPOSITION RATIONALE-

(A) DESIGN:

REFER TO APPENDIX X1, ENERGIA HARDWARE.

(B) TEST:

REFER TO APPENDIX X1, ENERGIA HARDWARE.

DOCKING RING EXTENSION AND RETRACTION CONTROL CIRCUIT OPERATION IS VERIFIED DURING GROUND CHECKOUT. ANY TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

REFER TO APPENDIX X1, ENERGIA HARDWARE.

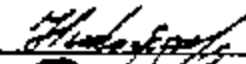

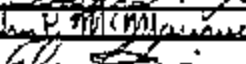
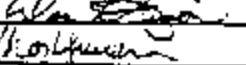
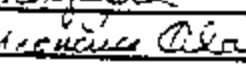

(D) FAILURE HISTORY:

REFER TO APPENDIX X1, ENERGIA HARDWARE.

(E) OPERATIONAL USE:

AFTER SECOND/THIRD FAILURE, CREW COULD PERFORM AN IN-FLIGHT MAINTENANCE | TO DRIVE THE RING MOTORS DIRECTLY FROM THE FEED-THROUGH CONNECTORS IN THE EXTERNAL AIRLOCK, USING THE ORBITER BREAKOUT BOX.

- APPROVALS -

PRODUCT ASSURANCE ENGR	:	M. NIKOLAYEVA	:	
DESIGN ENGINEER	:	B. VAKULIN	:	
NASA SSMA	:		:	
NASA SUBSYSTEM MANAGER	:		:	
JSC MOD	:		:	
NASA EPDC SSMA	:		:	
NASA EPDC SUBSYSTEM MANAGER:	:		:	