

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE

NUMBER: M5-6MB-2018-G -X

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC

REVISION: 9 04/16/96

PART DATA

| PART NAME | PART NUMBER |
|-----------------------|-----------------|
| VENDOR NAME | VENDOR NUMBER |
| LRU : PANEL O14 | V070-730299 |
| LRU : PANEL O15 | V070-730300 |
| LRU : PANEL O16 | V070-730301 |
| LRU : PANEL A15 | V070-730372 |
| LRU : PANEL ML86B | V070-730382 |
| SRU : CIRCUIT BREAKER | MC454-0026-2030 |

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

CIRCUIT BREAKER, THREE AMPERE - LO2 TANKS 1 THRU 9 HEATER CIRCUIT CURRENT LEVEL DETECTOR.

REFERENCE DESIGNATORS:

- 33V73A14CB6
- 33V73A15CB6
- 33V73A16CB4
- 33V73A16CB5
- 36V73A15CB7
- 36V73A15CB8
- 36V73A15CB13
- 36V73A15CB14
- 36V73A15CB19
- 36V73A15CB20
- 36V73A15CB25
- 36V73A15CB26
- 60V73A130CB37
- 60V73A130CB38
- 60V73A130CB43
- 60V73A130CB47
- 60V73A130CB89
- 60V73A130CB90

FAILURE MODES EFFECTS ANALYSIS (FMEA) -CIL HARDWARE

NUMBER: M5-6MB-2018-G-X

QUANTITY OF LIKE ITEMS:
TWO PER H2/O2 BOX

FUNCTION:
PROVIDES OVERLOAD PROTECTION FOR AND CONDUCTS POWER TO THE LO2 TANK
HEATER CURRENT LEVEL DETECTORS.

- APPROVALS -

PRODUCT ASSURANCE ENGR : J. NGUYEN
DESIGN ENGINEERING : T. D. NGUYEN

Editorially APPROVED JSC

Atell
Atell
at Nancy 9-12-97

PRINT DATE: 09/09/92

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M5-6MB-2018-G-01

REVISION# 9 09/09/92
SUBSYSTEM: ELECTRICAL POWER GENERATION - CRYO, GENERIC
LRU PANEL 014
ITEM NAME: CIRCUIT BREAKER
CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS OPEN, FAILS TO CONDUCT, FAILS TO CLOSE

MISSION PHASE:
OO OK-ORBIT

| | | |
|----------------------------------|-------|-----------|
| VEHICLE/PAYLOAD/KIT EFFECTIVITY: | 102 | COLUMBIA |
| | : 103 | DISCOVERY |
| | : 104 | ATLANTIS |
| | : 105 | ENDEAVOUR |

CAUSE:
STRUCTURAL FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PROCESSING ANOMALY, THERMAL STRESS

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)
B)
REDUNDANCY SCREEN "B" FAILS BECAUSE LOSS OF POWER TO ONE SERIES CURRENT LEVEL DETECTOR IS NOT READILY DETECTABLE IN FLIGHT, AND CAN BE DETECTED ONLY IF THE TEST CIRCUIT IS USED OR IF A DIFFERENTIAL CURRENT CONDITION OCCURS.
C)

PRINT DATE: 09/09/92

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
 NUMBER: M5-6MB-2010-G-01

 - FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF ABILITY TO ENERGIZE ONE SET OF REDUNDANT CURRENT LEVEL DETECTORS.

(B) INTERFACING SUBSYSTEM(S):

LOSS OF REDUNDANT PROTECTION AGAINST LO2 TANK HEATER ELEMENT INCURRING INTERNAL SHORT TO STRUCTURE.

(C) MISSION:

NO EFFECT - FIRST FAILURE

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

NO EFFECT - FIRST FAILURE

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE DUE TO THE FOLLOWING SCENARIO:

1) CIRCUIT BREAKER FAILS TO CONDUCT - LOSS OF ONE OF TWO SERIES REDUNDANT CURRENT LEVEL DETECTORS (CLD'S) IN EACH AFFECTED LO2 TANK HEATER CIRCUIT, 2) SECOND SERIES REDUNDANT CLD FAILS, 3) LO2 TANK HEATER SHORTS THROUGH ONE OF ITS DOUBLE LAYERS OF INSULATION, AND 4) SAME LO2 TANK HEATER SHORTS TO STRUCTURE THROUGH ITS SECOND LAYER OF INSULATION, POSSIBLY INDUCING LOCALIZED HOT SPOTS, RESULTING IN POSSIBLE LO2 TANK RUPTURE/EXPLOSION.

 - DISPOSITION RATIONALE -

(A) DESIGN:

REFER TO APPENDIX D, ITEM NO. 1 - CIRCUIT BREAKER

(B) TEST:

REFER TO APPENDIX D, ITEM NO. 1 - CIRCUIT BREAKER

CIRCUIT BREAKER INTEGRITY IS VERIFIED IN FLIGHT DURING LO2 TANK HEATER CURRENT LEVEL SENSOR TESTS. PERFORM GROUND TURNAROUND TEST,

(TANKS 1-5) WHEN VALID VERIFICATION IS UNOBTAINABLE IN FLIGHT, OR AFTER LRU REPLACEMENT.

(TANKS 6-9) PRIOR TO FIRST EDO FLIGHT, WHEN VALID VERIFICATION IS UNOBTAINABLE IN FLIGHT, OR AFTER LRU REPLACEMENT.

(C) INSPECTION:

REFER TO APPENDIX D, ITEM NO. 1 - CIRCUIT BREAKER

(D) FAILURE HISTORY:

REFER TO APPENDIX D, ITEM NO. 1 - CIRCUIT BREAKER

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE

NUMBER: M5-6MB-2018-G-01

(E) OPERATIONAL USE:

CREW ACTION REQUIRED TO TURN OFF AFFECTED HEATER SYSTEMS AFTER THE SECOND FAILURE.

- APPROVALS -

| | | | | |
|------------------------|---|----------------|---|--|
| PRODUCT ASSURANCE MGR | : | T. J. EAVENSON | : | <u>T. J. Eavenson 9/14/92</u> |
| PRODUCT ASSURANCE ENG | : | T. K. KIMURA | : | <u>T. K. Kimura 9/14/92</u> |
| DESIGN ENG TEAM LEADER | : | G. M. ANDERSON | : | <u>G. M. Anderson 9.15.92.</u> |
| DESIGN ENGINEERING | : | T. D. NGUYEN | : | <u>T. D. Nguyen 9/15/92</u> |
| NASA RELIABILITY | : | | : | <u>M. B. Fitzpatrick 12/16/92</u> |
| NASA SUBSYSTEM MANAGER | : | | : | <u>Approved by Woodard 12/16/92</u> |
| NASA EPD&C RELIABILITY | : | | : | <u>Lambert Corp. For S. Woodard 12/17/92</u> |
| NASA QUALITY ASSURANCE | : | | : | <u>HIFKO (M. Mathan) 10/6/92</u> |
| NASA EPD&C SUBSYS MGR | : | | : | <u>Approved by F. Albrecht 14 Dec 92</u> |