

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE**  
**NUMBER: 05-6WD-4070 -X**

SUBSYSTEM NAME: EPD&amp;C - ATCS/FCL

REVISION: 0 12/02/97

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**PART DATA**


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|     | <b>PART NAME</b>       | <b>PART NUMBER</b>   |
|-----|------------------------|----------------------|
|     | <b>VENDOR NAME</b>     | <b>VENDOR NUMBER</b> |
| LRU | : PANEL L2A1           | V070-730273          |
| SRU | :RELAY, 2 THROW HYBRID | MC455-0135-0002      |

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

RELAY K1, AUTOMATIC CONTROL CIRCUIT, FREON LOOP BYPASS VALVE CONTROL  
 SUBSYSTEM.

**REFERENCE DESIGNATORS:** K1  
 K2

**QUANTITY OF LIKE ITEMS:** 2  
 TWO

**FUNCTION:**

RELAY PROVIDES AC POWER TO THE BYPASS VALVES IN THE AUTOMATIC MODE IN THE  
 BYPASS DIRECTION ONLY.

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

NUMBER: 05-6WD-4070-02

REVISION#: 0 12/16/97

SUBSYSTEM NAME: EPD&amp;C - ATCS/FCL

LRU: PANEL L2A1

CRITICALITY OF THIS

ITEM NAME: RELAY, HYBRID (DOUBLE THROW)

FAILURE MODE: 1R3

**FAILURE MODE:**

FAILS CLOSED, FAILS TO OPEN, PREMATURE CLOSURE, SHORTS CONTACT-TO-CONTACT.

**MISSION PHASE:**LO LIFT-OFF  
OO ON-ORBIT**VEHICLE/PAYLOAD/KIT EFFECTIVITY:**102 COLUMBIA  
103 DISCOVERY  
104 ATLANTIS  
105 ENDEAVOUR**CAUSE:**

PIECE PART FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PROCESSING ANOMALY, THERMAL STRESS

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

**REDUNDANCY SCREEN**A) PASS  
B) PASS  
C) PASS**PASS/FAIL RATIONALE:**

A)

B)

IF THE RELAY FAILS CLOSED ISOLATION VALVE WILL SWITCH TO RAD BYPASS WHICH CAN BE DETECTED AND OVERRIDDEN BY THE MANUAL SWITCH.

C)

**- FAILURE EFFECTS -**

(A) SUBSYSTEM:

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE  
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RELAY K1 (STARBOARD) ( OR K2 PORT) FAILS CLOSED WILL CAUSE STARBOARD ISOLATION VALVE MOTORS TO BE POWERED CONTINUOUSLY WHICH CAN BE FIXED BY SETTING SWITCH S26 TO MANUAL.

**(B) INTERFACING SUBSYSTEM(S):**  
NONE.

**(C) MISSION:**  
PROBABLE LOSS OF MISSION AFTER 2 FAILURES:  
(1) RELAY K1 STARBOARD (OR K2 PORT) FAILS CLOSED CONTINUOUSLY ENERGIZING MOTORS IN STARBOARD (OR PORT) ISOLATION VALVE THUS SETTING IT TO RAD BYPASS POSITION.  
(2) SWITCH S26 FAILS IN AUTO POSITION (CANNOT GO TO MANUAL) RESULTING IN LOSS OF ABILITY TO MANUALLY SWITCH TO RAD FLOW THEREBY LOSING RADIATOR COOLING FOR THAT COOLANT LOOP.

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
FOUR FAILURE SCENARIO:  
POSSIBLE LOSS OF CREW/VEHICLE AFTER 4 FAILURES:  
(1) RELAY K1 STARBOARD (OR K2 PORT) FAILS CLOSED CAUSING CONTINUOUS ENERGIZING OF ISOLATION VALVE MOTORS SETTING VALVE TO RAD BYPASS POSITION WITH SUBSEQUENT LOSS OF RADIATOR COOLING FOR THAT LOOP AND POSSIBLE MANUAL SWITCHING OF S28 STARBOARD (OR S27 PORT) TO RAD FLOW POSITION TO INCREASE VEHICLE COOLING  
(2) EXTERNAL LEAK IN ASSOCIATED RADIATOR ARRAY  
(3) S28 STARBOARD (OR S27 PORT) FAILS IN RAD FLOW POSITION (CANNOT BE SWITCHED TO RAD BYPASS) CAUSING LOSS OF FREON FOR ASSOCIATED COOLANT LOOP THROUGH RADIATOR RUPTURE.  
(4) LOSS OF REDUNDANT COOLANT LOOP CAUSING LOSS OF ALL VEHICLE COOLING.

FOUR FAILURE SCENARIO:  
POSSIBLE LOSS OF CREW/VEHICLE AFTER 4 FAILURES:  
(1) RELAY K1 STARBOARD (OR K2 PORT) FAILS CLOSED CAUSING CONTINUOUS ENERGIZING OF ISOLATION VALVE MOTORS SETTING VALVE IN RAD BYPASS POSITION WITH SUBSEQUENT LOSS OF RADIATOR COOLING FOR THAT LOOP  
(2) EXTERNAL LEAK IN ASSOCIATED RADIATOR ARRAY  
(3) S28 FAILS IN TO AUTO POSITION (CANNOT BE SWITCHED TO MANUAL) CAUSING LOSS OF FREON IN THAT COOLANT LOOP THROUGH RADIATOR RUPTURE WITH RESULTANT LOSS OF COOLANT LOOP  
(4) LOSS OF REDUNDANT COOLANT LOOP CAUSING LOSS OF ALL VEHICLE COOLING

**(E) FUNCTIONAL CRITICALITY EFFECTS:**  
SEE SECTIONS C AND D ABOVE.

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

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- APPROVALS -

SS & PAE MANAGER  
SS & PAE ENGINEER  
EPD&C ATC  
BNA SSM  
JSC MOD  
JSC RDE

: D. F. MIKULA  
: K. E. RYAN  
: D. SOVEREIGN  
: R. L. PHAN  
:

*D.F. Mikula*  
*K.E. Ryan*  
*D. Sovereign*  
*R. L. Phan*  
*[Signature]*

Nanette Cozma 11-24-98

*USA/whiter*

*Sezenye Sente*  
*[Signature]* 1/19/99