

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

NUMBER: 06-1B-0835-X

SUBSYSTEM NAME: ARS - COOLING

REVISION : 7 06/26/92

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	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ LRU :	REGENERABLE CO2 REMOVAL SYSTEM	MC623-0016
■ SRU :	LINKAGE	SV807067

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PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

■ QUANTITY OF LIKE ITEMS: 2

■ FUNCTION:

TWO INDEPENDENT LINKAGE ASSEMBLIES CONTROL THE VACUUM CYCLE VALVE POPPETS. A LINKAGE RUNS BETWEEN THE TWO PAIRS OF VCV'S AT EITHER END OF THE SORBENT BEDS AND INTERCONNECTS THE AIR SIDE POPPETS OF ONE BED TO THE VACUUM SIDE POPPETS OF THE OTHER.

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SUBSYSTEM: ARS - COOLING  
LRU :REGENERABLE CO2 REMOVAL SYSTEM  
ITEM NAME: LINKAGE

REVISION# 7 06/26/92 R

CRITICALITY OF THIS  
FAILURE MODE:2/2

- FAILURE MODE:  
STRUCTURAL FAILURE, BINDING/JAMMING

MISSION PHASE:  
00 ON-ORBIT

- VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA  
: 105 ENDEAVOUR

- CAUSE:  
MECHANICAL SHOCK, VIBRATION, CORROSION, MATERIAL DEFECT.

- CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

- REDUNDANCY SCREEN A) N/A
- B) N/A
- C) N/A

PASS/FAIL RATIONALE:

- A)
- B)
- C)

- MASTER MEAS. LIST NUMBERS: V61P2901A  
: V61P2902A  
: V61P2911A  
: V61P2912A  
: V61P2922A

- FAILURE EFFECTS -

- (A) SUBSYSTEM:  
ACTUATOR MOTION CANNOT BE TRANSLATED TO VALVES, THUS RESULTING IN  
INABILITY TO OPEN/CLOSE PROCESS AIR PORTS AND VACUUM PORTS. LOSS OF  
USE OF THE RCRS.

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- (B) INTERFACING SUBSYSTEM(S):  
INCREASED CABIN PPCO2.
- (C) MISSION:  
EARLY TERMINATION OF MISSION.
- (D) CREW, VEHICLE, AND ELEMENT(S):  
NO EFFECT.
- (E) FUNCTIONAL CRITICALITY EFFECTS:
  - 1) LOSS OF USE OF THE RCRS. BACKUP LIOH CANISTER MUST BE USED FOR CO2 REMOVAL UNTIL LANDING. THE LIOH SUPPLY IS ADEQUATE TO ACCOMMODATE 3 DAY MISSION. LOSS OF ALL BACKUPS MAY RESULT IN LOSS OF CREW/VEHICLE. A 1R3 PPP CRITICALITY SCENARIO RESULTS.
  - 2) EXCESSIVE LOSS OF CONSUMABLES IF BOTH VACUUM AND AIR POPPETS IN EITHER BED FAILED OPEN. A 1R3 PPP CRIT SCENARIO RESULTS IF THE VACUUM VENT ISOLATION VALVE ALSO FAILS OPEN.

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- DISPOSITION RATIONALE -  
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- (A) DESIGN:  
THE LINKAGE ASSEMBLY HAS TITANIUM CRANK ARMS MOUNTING IN RULON BUSHINGS. THE ARMS DRIVE ALUMINUM PUSHRODS WITH THREADED ENDS FOR ASSEMBLY ADJUSTMENT. THE PUSHROD IS SPRING LOADED TO ALLOW OVERTRAVEL TOLERANCE TO ELIMINATE ANY POTENTIAL STRUCTURE DAMAGE.
- (B) TEST:  
QUALIFICATION TEST FOR 100 MISSIONS:  
THE LINKAGES ARE TESTED WHEN INSTALLED AT THE RCRS PACKAGE LEVEL. RANDOM VIBRATION INCREASING AT PLUS 6 db/oct FROM 20 TO 45 HZ; CONSTANT AT 0.003 g2/HZ FROM 45 TO 1000 HZ; DECREASING AT MINUS 6 db/oct FROM 1000 TO 2000 HZ FOR 48 MINUTES PER AXIS IN THREE ORTHOGONAL AXES. LINKAGE ASSEMBLY IS TESTED ALONG WITH THE VCV ASSEMBLY FOR 50,000 CYCLES WITH NO EVIDENCE OF FAILURE OR DAMAGE TO VERIFY DESIGN LIFE REQUIREMENTS.  
  
ACCEPTANCE TEST:  
PERFORMANCE TESTED TO VERIFY PROPER LINKAGE OPERATION. CONTINUOUS 16+2 DAY SIMULATION TESTED WITH SEVEN MAN CREW SIZE AT CABIN PRESSURE OF 14.7 AND 10.2 PSIA WITH NO FAILURE TO REMOVE 2.11 lbs/man/day OF CO2.  
OMRSD:  
ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD AT SYSTEM LEVEL.

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■ (C) INSPECTION:

RECEIVING INSPECTION

INCOMING PART/MATERIAL IDENTIFICATION AND CERTIFICATION VERIFIED BY INSPECTION. DIMENSIONAL INSPECTION OF PARTS PERFORMED AT VENDOR BY SOURCE INSPECTION. MATERIAL VERIFICATION PERFORMED TO H. S. REQUIREMENTS. ANODIZE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CONTAMINATION CONTROL PROCESSES AND CLEAN AREAS VERIFIED BY INSPECTION. PARTS VERIFIED VISUALLY CLEAN.

ASSEMBLY/INSTALLATION

ASSEMBLY/INSTALLATION/RIGGING VERIFIED BY INSPECTION. RIGGING/STAKE OPERATIONS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

TORQUE OPERATIONS VERIFIED TO H. S. REQUIREMENTS.

TESTING

FUNCTION VERIFIED DURING RCRS UNIT ATP TESTING WHICH IS VERIFIED BY INSPECTION. VIBRATION TEST OF ORIGINAL DEVELOPMENT RCRS ASSEMBLY VERIFIED BY INSPECTION DURING QUALIFICATION.

HANDLING/PACKAGING

PACKAGING/PARTS PROTECTION MAINTAINED PER H. S. REQUIREMENTS.

■ (D) FAILURE HISTORY:

NO FAILURE HISTORY.

■ (E) OPERATIONAL USE:

1) SHUTDOWN THE RCRS.

2) CLOSE THE VACUUM VENT ISOLATION VALVE TO LIMIT AIR LOSS TO VACUUM TO MAXIMUM 4 LBS/HR.

3) INSTALL NEW LIOH CANISTERS FOR CO2 REMOVAL. LIOH SUPPLY IS ADEQUATE FOR 3 DAYS.

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- APPROVALS -

RELIABILITY MANAGER : T. J. EAVENSON  
 DESIGN ENGINEERING : P. J. CHEN  
 QUALITY ENGINEERING : E. OCHOA  
 NASA RELIABILITY :  
 NASA SUBSYSTEM MANAGER :  
 NASA QUALITY ASSURANCE :

*K. L. Patten for 6/30/92*  
~~PS~~  
~~by K. L. Patten for T. J. Eavenson 6/2/92~~  
~~for T. J. Eavenson 7/15/92~~  
~~9/9/92~~  
~~8-2-92~~  
*K 8/2/92*