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PRINT DATE: 08/27/93

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE  
NUMBER: 06-1C-1511-X**

**SUBSYSTEM NAME: ARS - ARPCS**

**REVISION:**

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	<b>PART NAME VENDOR NAME</b>	<b>PART NUMBER VENDOR NUMBER</b>
LRU	: RESTRICTOR	V594-613101-002
SRU	: RESTRICTOR, FLOW, O2 THE LEE COMPANY	ME251-0011-0003 VDCX0502950B

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**PART DATA**

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

**QUANTITY OF LIKE ITEMS: 1**

**FUNCTION:**

RESTRICTOR ASSEMBLY, EMERGENCY O2 FLOW

PROVIDES 10 +/- 1 LB/HR DIRECT OXYGEN FLOW INTO CABIN DURING 8.0 PSIA CONTINGENCY OPERATIONS. THE PURPOSE OF THIS FLOW IS TO MAINTAIN AN O2/N2 MIXTURE FOR CREW BREATHING IN THE EVENT OF A FAILURE IN THE LES.

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ATTACHMENT  
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FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE  
NUMBER: 06-1C-1511-01

REVISION# 2 07/18/90

SUBSYSTEM: ARS - ARPCS  
LRU :RESTRICTOR  
ITEM NAME: RESTRICTOR, FLOW, O2

CRITICALITY OF THIS  
FAILURE MODE:1R2

FAILURE MODE:  
RESTRICTED FLOW, CLOGGED

MISSION PHASE:

PL PRELAUNCH  
LO LIFT-OFF  
OO ON-ORBIT  
DO DE-ORBIT  
LS LANDING SAFING

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

CAUSE:  
CONTAMINATION, CORROSION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:

A)

B)

SCREEN B IS N/A BECAUSE THE RESTRICTOR ASSEMBLY IS IN STANDBY UNTIL  
REQUIRED.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF ABILITY TO FLOW 10 LB/HR INTO CABIN.

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(B) INTERFACING SUBSYSTEM(S):  
DECREASED PERCENTAGE OF OXYGEN IN CABIN AIR MIXTURE DURING 8.0 PSIA  
CONTINGENCY.

(C) MISSION:  
NO EFFECT - ABORT ALREADY IN PROGRESS.

(D) CREW, VEHICLE, AND ELEMENT(S):  
NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:  
SECOND ASSOCIATED FAILURE, IN LES O2 SUPPLY, WHICH REQUIRES A  
CREWMEMBER TO BREATHE CABIN AIR, RESULTS IN LOSS OF CREW AND POSSIBLY  
VEHICLE.

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- DISPOSITION RATIONALE -  
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(A) DESIGN:  
THE BODY ASSEMBLY IS MADE OF 303 CRES STAINLESS STEEL WHICH IS HIGHLY  
RESISTENT TO CORROSION IN AN O2 ATMOSPHERE. THE RESTRICTOR IS CALLED A  
VISCO JET WHICH CONTAINS UNIQUELY DESIGNED PLATES WITHIN THE RESTRICTOR  
WHICH UTILIZE MULTIPLE OPENINGS IN LIEU OF THE USUAL SINGLE PASSAGE.  
THIS MAKES THE UNIT LESS SUSCEPTIBLE TO EROSION AND MORE RELIABLE.  
ALSO, THE FLOW PATTERN WITHIN THE PLATES IS DESIGNED TO ALLOW LARGER  
OPENINGS THAN WOULD BE REQUIRED WITH A SINGLE ORIFICE. THE UNIT IS  
THUS MUCH LESS PRONE TO RESTRICTION BY CONTAMINATION.

(B) TEST:  
ACCEPTANCE TEST - PROOF PRESSURE, LEAK AND FLOW TESTED.

QUALIFICATION TEST - RANDOM VIBRATION FOR 84 MIN/AXIS AT +6 DB/OCT  
FROM 20-80 HZ, 0.3 G\*\*2/HZ CONSTANT AT 80-300 HZ, AND -6DB/OCT FROM 300-  
2000 HZ. TRANSIENT VIBRATION TESTED IN SINUSOIDAL VIBRATION  
ENVIRONMENTS IMPOSED IN THE FREQUENCY RANGE FROM 5 TO 35 HZ AT AN  
ACCELERATION AMPLITUDE OF + OR - 0.25 G PEAK. DESIGNED TO WITHSTAND A  
20 G TERMINAL SHOCK. SHOCK TESTED USING SAWTOOTH SHOCK PULSE OF 11  
MILLISECONDS DURATION IN EACH OF THE 3 ORTHOGONAL AXES (6 DIRECTIONS).  
FREDM TUBES WERE BURST PRESSURE TESTED FOR 5 MINUTES AT 1240 +50/-0  
PSIG (PRESSURE INCREASED AT A RATE NOT EXCEEDING 300 PSIG/MIN) WITH THE  
O2 TUBE VENTED. OXYGEN TUBES WERE BURST PRESSURE TESTED FOR 5 MINUTES  
AT 2580 +100/-0 PSIG (PRESSURE INCREASED AT A RATE NOT EXCEEDING 300  
PSIG/MIN) WITH THE O2 TUBE VENTED. TEMPERATURE CYCLED 4 TIMES FROM  
+150F (HELD ONE HOUR) TO -65F (HELD ONE HOUR)

IN-VEHICLE TESTING - OBSTRUCTION FLOW TEST IS PERFORMED AT 850 - 900

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PSIG, 75 LB/HR MINIMUM FLOW.

OMRSD - LES MANUAL VALVES CHECKOUT VERIFIES FLOW PRIOR TO FIRST REFLIGHT OF EACH ORBITER AND EVERY FIVE FLIGHTS.

(C) INSPECTION:  
RECEIVING INSPECTION  
RAW MATERIAL VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL  
CLEANLINESS LEVEL 200A PER MA0110-301 AND 100 ML RINSE TEST VERIFIED BY INSPECTION. CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION  
FABRICATION OF PARTS/COMPONENTS PER DRAWING VERIFIED BY INSPECTION. DIMENSIONAL INSPECTION ARE PERFORMED AND VERIFIED BY INSPECTION. RIGID TUBING INSTALLATION PER DRAWING INCLUDING LUBRICANT AND TORQUES VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION  
PENETRANT INSPECT PER MIL-I-6866 PERFORMED AND VERIFIED BY INSPECTION.

CRITICAL PROCESSES  
PARTS PASSIVATION VERIFIED BY INSPECTION. APPLICATION OF LUBRICANT ON SEAL RING VERIFIED BY INSPECTION.

TESTING  
ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING  
HANDLING, PACKAGING, STORAGE AND SHIPPING PROCEDURES ARE VERIFIED.

(D) FAILURE HISTORY:  
NO FAILURE HISTORY APPLICABLE TO RESTRICTED FLOW FAILURE MODE. THE RESTRICTOR HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM CONSIDERING THIS FAILURE MODE.

(E) OPERATIONAL USE:

~~788~~  
*NONE*

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- APPROVALS -

RELIABILITY ENGINEERING:	D. R. RISING	<i>DRR</i>	:	
DESIGN ENGINEERING	: K. KELLY	<i>KK</i>	:	<i>[Signature]</i>
QUALITY ENGINEERING	: M. SAVALA		:	<i>[Signature]</i>
NASA RELIABILITY	:		:	<i>[Signature]</i>
NASA SUBSYSTEM MANAGER	:		:	<i>[Signature]</i>
NASA QUALITY ASSURANCE	:		:	<i>[Signature]</i>

*JRB* *3/8/91* *4-2-91* *4/3/91* *3/24/91*