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

SUBSYSTEM NAME: ARS - ARPCS

REVISION:

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

PART DATA

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.

PRINT DATE: 08/27/93

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL FAILURE MODE
NUMBER: 06-1C-1511-02

REVISION# 8 08/26/93 R

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

CRITICALITY OF THIS FAILURE MODE: 1R2

FAILURE MODE:
INABILITY TO RESTRICT

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:
MECHANICAL SHOCK, VIBRATION, MISHANDLING OR ABUSE

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN
A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF OXYGEN UNTIL CORRECTING ACTION (C/A) IS IMPLEMENTED.

(B) INTERFACING SUBSYSTEM(S):
INCREASED PPO2 IN CABIN UNTIL C/A TAKES EFFECT.

(C) MISSION:
NO EFFECT.

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

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(E) FUNCTIONAL CRITICALITY EFFECTS:
SECOND ASSOCIATED FAILURE, DIRECT O2 VALVE, INABILITY TO CLOSE, RESULTS IN INADEQUATE O2 SUPPLY TO LES STATIONS. THE LOSS OF LES SUPPORT CAPABILITY MAY RESULT IN LOSS OF CREW IF LEAK RATE PROHIBITS LES SYSTEM PRESSURIZATION AND LES ARE REQUIRED. NOTE - IN AN 8.0 PSIA HOLE IN CABIN CONTINGENCY MODE, EXCESS FLOW INTO THE CABIN MAY NOT BE CATASTROPHIC SINCE THERE IS A POSSIBILITY OF SAFELY BREATHING THE CABIN AIR BY RAISING LES VISORS. THE WORST CASE FAILURE WOULD BE IN THE CASE OF A CONTAMINATED CABIN ATMOSPHERE, WHEN THIS FAILURE PREVENTS ADEQUATE FLOW TO LES STATIONS AND CABIN AIR MAY NOT BE SAFE FOR BREATHING.

-DISPOSITION RATIONALE-

(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). FREON 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 PSIG, 75 LB/HR MINIMUM FLOW.

OMRSD - FLOW TEST IS PERFORMED BEFORE THE FIRST REFLIGHT OF EACH ORBITER AND AS A CONTINGENCY FOR LRU REPLACEMENT, AT 800 - 835 PSIG, 17.0 - 22.0 LB/HR FLOW.

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

CONTAMINATION CONTROL

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CLEANLINESS LEVEL 200A PER MAO110-301 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 INABILITY TO RESTRICT FAILURE MODE. THE RESTRICTOR HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM CONSIDERING THIS FAILURE MODE.

(E) OPERATIONAL USE:
CLOSE DIRECT O2 ISOLATION VALVE.

- APPROVALS -

EDITORIALLY APPROVED	: RI
EDITORIALLY APPROVED	: JSC
TECHNICAL APPROVAL	: VIA CR

8/27/93
8/31/93
350260Y