PRINT DATE: 08/27/93

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL HARDWARE
NUMBER: 06-1C-0122-X

SUBSYSTEM NAME: ARS - ARPCS

REVISION: B 08/26/93

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	EMERGENCY O2 CONTROL PANEL CARLETON TECHNOLOGIES	MC250-0002-0120 2735-0001
SRU	:	VALVE, RELIEF & REG, EM O2	1-4-00-58-15

PART DATA

QUANTITY OF LIKE ITEMS: 2
ONE PER FLOW PATH
TWO PER PANEL

FUNCTION:
RELIEF VALVE, EMERGENCY O2 REGULATOR

PROVIDE OVERPRESSURE RELIEF CAPABILITY DOWN STREAM OF EMERGENCY OXYGEN REGULATOR. RELIEF PRESSURE IS 245 PSIG. THIS VALVE IS INTEGRAL TO THE ON/OFF VALVE AND THE REGULATOR.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ATMOSPHERIC REVIT. FMEA NO 06-1C -0122 -2 REV:08/1(

ASSEMBLY :EMERGENCY 02 CONTROL PNL
P/N RI :MC250-0002-0120
P/N VENDOR:1-4-00-58-15 CARLETON
QUANTITY :2
:ONE PER REGULATOR
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102 X	103 X	104 X

PHASE(S): PL X LO X OO X DO X LS X

REDUNDANCY SCREEN: A-PASS B-N/A C-PASS

PREPARED BY:
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REL N. L. STEISSLINGER
QE S. MOR

APPROVED BY
DES
REL
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APPROVED BY (NASA):
SSM
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QE
9/23/97

ITEM:
RELIEF VALVE, EMERGENCY 02 REGULATOR

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PROVIDE OVERPRESSURE RELIEF CAPABILITY DOWN STREAM OF EMERGENCY OXYGE: REGULATOR. RELIEF PRESSURE IS 245 PSIG. THIS VALVE IS INTEGRAL TO THI ON/OFF VALVE AND THE REGULATOR.

FAILURE MODE:
CLOSED

CAUSE(S):
MECHANICAL SHOCK, VIBRATION, CONTAMINATION, CORROSION

EFFECT(S) ON:
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE

(A) LOSS OF OVERPRESSURE PROTECTION AGAINST A FAILED REGULATOR. PANEL OUTLET PRESSURE WOULD RISE TO INLET PRESSURE AND IMPLEMENTATION OF CORRECTING ACTION (C/A) WOULD CLOSE ONE OF TWO REDUNDANT 02 FLOW PATHS.

(B) LES BREATHING STATIONS INTERFACE WOULD GET PRESSURE UP TO 1050 PSIG.

(C) ABORT DECISION.

(D) NO EFFECT. LES EQUIPMENT CONTAINS RELIEF VALVES AND WHEN PUT INTO USE OVERPRESSURE WOULD RELIEVE INTO CABIN RESULTING IN PPO2 INCREASE UNTIL C/A IS IMPLEMENTED.

(E) FUNCTIONAL CRITICALITY EFFECT - SUBSEQUENT FAILURE OF REDUNDANT SYSTEM RESULTS IN LOSS OF OXYGEN SUPPLY TO LES BREATHING STATIONS. SCREEN B IS N/A BY DEFINITION OF RELIEF VALVES AS STANDBY REDUNDANCY.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ATMOSPHERIC REVIT. FMEA NO 06-1C -0122 -2 REV:08/10/88

DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A) DESIGN
THE VALVE BODY IS MADE OF ALUMINUM ALLOY 6061. THE REGULATOR IS AN INLET PRESSURE COMPENSATED, SPRING-REFERENCED TYPE EMPLOYING A 17-7 PH CONDITION C CRES DIAPHRAGM AS A SENSING ELEMENT AND DYNAMIC SEAL. 17-7 PH IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL WHICH HAS A HIGH STRENGTH TO WEIGHT RATIO. THE DIAPHRAGM SEALS WHICH ARE MADE OF SILASTIC 675 SILICONE RUBBER HAVE EXCELLENT RESISTANCE TO OXYGEN, OUTGASSING, AND FATIGUE. THEY ELIMINATE THE FRICTION AND WEAR ASSOCIATED WITH PISTON TYPE SEALS. THE HELICAL/BELLEVILLE SPRING COMBINATION WHICH IS MADE OF 17-7 PH CRES PROVIDES REGULATION AND ASSURES A CLOSE TOLERANCE OPERATION OVER A WIDE FLOW RANGE. THE POPPET WHICH IS ALSO MADE OF 17-7 PH CRES WORKS AGAINST A POLYIMIDE VESPEL SP-1 SEAT WHICH ASSURES A LEAK FREE OPERATION. THE INLET AND OUTLET PORTS ARE FILTER PROTECTED TO 25 MICRONS.

(B) TEST
ACCEPTANCE TEST - PROOF TEST AT 1875 +/- 25 PSIG FOR A MINIMUM OF 3 MINUTES. LEAK TESTED AT INLET PRESSURE 885 +/- 25 PSIG AND OUTLET PRESSURE 125 PSIG; 0.3 SCCM MAX LEAKAGE. INTERNAL LEAKAGE TEST PERFORMED AT THE SAME PRESSURE; 0.2 SCCM MAX LEAKAGE. RELIEF VALVE OPERATIONAL TEST AT A CRACKING PRESSURE OF 245 PSIG MAX AND A RESEAT PRESSURE OF 215 PSIG MINIMUM.

QUALIFICATION TEST - LIFE CYCLE TESTING - 1000 CYCLES AT 875 +/- 25 PSIG. BURST PRESSURE IS 2500 PSIG. SUBJECTED TO THE FOLLOWING AS PART OF THE EMERGENCY O2 CONTROL PANEL. DESIGN SHOCK - THE UNIT WAS SUBJECTED TO 3 SHOCKS OF A 20 G PEAK ACCELERATION PULSE APPROXIMATELY A SAWTOOTH AND HAVING A TOTAL DURATION OF 11 MILLISECONDS. THIS PULSE WAS APPLIED IN BOTH DIRECTIONS OF THE THREE PRINCIPLE AXES FOR A TOTAL OF 18 SHOCKS. RANDOM VIBRATION SPECTRUM ENVELOPE - 20 TO 150 HZ INCREASING AT 6 DB/ OCTAVE TO 0.03 G**2/HZ AT 150 HZ. CONSTANT AT 0.03 G**2/HZ FROM 150 TO 1000 HZ, DECREASING AT 6 DB/OCTAVE FROM 1000 TO 2000 HZ FOR 48 MINUTES PER AXIS FOR THREE ORTHOGONAL AXES. ATP TO VERIFY LEAKAGE IS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

IN-VEHICLE TESTING - RELIEF VALVE CRACK, RESEAT AND RESEAT LEAKAGE (10 SCCM MAX) TEST IS PERFORMED.

OMRSD - RELIEF VALVE CRACK, RESEAT AND RESEAT LEAKAGE (10 SCCM MAX) TEST IS PERFORMED BEFORE THE FIRST REFLIGHT OF EACH ORBITER AND AT INTERVALS OF FIVE FLIGHTS.

(C) INSPECTION

RECEIVING INSPECTION
RAW MATERIAL VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL
CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN ARE

VERIFIED BY INSPECTION. CLEANLINESS LEVEL 200A PER MAO110-301 VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
BELLEVILLE SPRING FORCES AND TORQUES ARE VERIFIED. DIMENSIONAL CHECKS ARE PERFORMED BY INSPECTION. MIPS FOR CONCENTRICITY AND PERPENDICULARITY. VISUAL INSPECTION USING 10X MAGNIFICATION ON SEAL RING VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
BRAZING, WELDING, X-RAYS AND PENETRANT INSPECTIONS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES
HEAT TREAT AND PARTS PASSIVATION AND ANODIZING ARE VERIFIED BY INSPECTION. LUBRICANT APPLICATION ON SEAL RING VERIFIED BY INSPECTION. POTTING VISUALLY VERIFIED BY INSPECTION. SOLDERING VERIFIED BY INSPECTION.

TESTING
ATP VERIFIED BY INSPECTION.

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

(D) FAILURE HISTORY
NO FAILURE HISTORY APPLICABLE TO CLOSED FAILURE MODE. THE RELIEF VALVE HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM CONSIDERING THIS FAILURE MODE.

(E) OPERATIONAL USE
TBS.