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PRINT DATE: 01/12/84

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE
NUMBER: 06-1C-0114-X**

SUBSYSTEM NAME: ARS - ARPCS

REVISION: 5 01/12/84

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: N2/O2 CONTROL PANEL CARLETON TECHNOLOGIES	MC250-0002-1001 2720-0001
SRU	: VALVE, SELECTOR, OXYGEN	1-4-00-51-43

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

QUANTITY OF LIKE ITEMS: 1

FUNCTION:

MANUAL ISOLATION VALVE - EMERGENCY OXYGEN (1.88) SELECTOR VALVE

PROVIDES THE CAPABILITY TO CONNECT OR ISOLATE THE AUXILIARY OXYGEN AND THE PRSD CRYO OXYGEN DISTRIBUTION SYSTEMS. WHEN THE AUXILIARY OXYGEN STORAGE TANK IS NOT INSTALLED THE VALVE SERVES ONLY TO ISOLATE THE INACTIVE AUXILIARY OXYGEN SYSTEM. THE LISTED FAILURE EFFECTS ARE FOR THE CASE WHEN THE AUX O2 TANK IS NOT INSTALLED. THE FAILURE EFFECTS FOR THE CASE OF THE TANK BEING INSTALLED WILL BE ADDRESSED IN THE MISSION KIT FMEA ON A MISSION BY MISSION BASIS.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE
NUMBER: 06-1C-0114-04**

REVISION# 5 01/12/94

SUBSYSTEM NAME: ARS - ARPCS
LRU: N2/O2 CONTROL PANEL
ITEM NAME: VALVE, SELECTOR, OXYGEN

CRITICALITY OF THIS
FAILURE MODE: 1R2

FAILURE MODE:
INTERNAL LEAKAGE
AUX O2 TANK NOT INSTALLED

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, CORROSION

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:
NO EFFECT. THE INACTIVE AUXILIARY O2 SYSTEM WOULD CONTAIN THE OXYGEN
LEAKING THROUGH THE VALVE.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT.

(C) MISSION:
NO EFFECT.

(D) CREW, VEHICLE, AND ELEMENT(S):

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NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:

SECOND ASSOCIATED FAILURE (EXTERNAL LEAKAGE UPSTREAM) RESULTS IN LOSS OF LES AND POSSIBLE LOSS OF CREW/VEHICLE.

-DISPOSITION RATIONALE-

(A) DESIGN:

VALVE BODY IS MADE OF 6061-T6 ALUMINUM ANODIZED FOR CORROSION RESISTANCE. FITTINGS ARE MADE OF 17-4 PH CONDITION A CRES, WHICH IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL AND HAS A HIGH STRENGTH TO WEIGHT RATIO. STATIC SEALS ARE MADE OF SILASTIC 675 SILICONE RUBBER. POPPET IS PRESSURE COMPENSATED THROUGH THE USE OF DYNAMIC SEALS AT EACH END, WHICH SLIDE ON THE VALVE STEM. VALVE STEM IS HIGHLY POLISHED FOR EASE OF OPERATION (REDUCED FRICTION PROTECTS SEALS). DYNAMIC SEALS ARE ALSO SILASTIC 675 SILICONE AND ARE LUBRICATED WITH BRAYCO LUBE. SILASTIC 675 SILICONE RUBBER HAS GOOD RESISTANCE TO ENVIRONMENTAL EXPOSURE, FLEXING AND FATIGUE. IT ALSO HAS LOW FLAMMABILITY AND OUTGASSING. THE OZONE RESISTANCE OF SILICONE RUBBER IS EXCELLENT. BRAYCO LUBE IS COMPATIBLE WITH LOW AND HIGH PRESSURE GO₂. INLET/OUTLET PORTS ARE FILTER PROTECTED TO 25 MICRONS. CONSTANT SEAT FORCES DUE TO BELLEVILLE CLOSING SPRING ELIMINATE EXCESS SEAL AND SEAT WEAR. OPERATING FORCE IS 4.5 POUNDS MAXIMUM AND IS INDEPENDENT OF PRESSURE LOADS. THE MOST PROBABLE LEAK (CUT O-RING) IS ESTIMATED AT 50 SCCM (0.175 LB/HR).

(B) TEST:

ACCEPTANCE TEST - ATP ON VALVE INCLUDES PROOF TEST AT 1875 PSIG (1.5 TIMES OPERATING PRESSURE). EXTERNAL LEAK TESTED FOR 0.2 SCCM MAX LEAKAGE AT 1250 PSIG FOR A MINIMUM OF 15 MINUTES. INTERNAL LEAK TESTED FOR 2 SCCM MAX LEAKAGE AT 1250 PSIG FOR A MINIMUM OF 15 MINUTES. ATP ON N₂/O₂ CONTROL PANEL AS AN ASSEMBLY INCLUDES EXAMINATION OF PRODUCT, RADIOGRAPHIC INSPECTION, PROOF PRESSURE AT 1870 +/- 20 PSIG, AND EXTERNAL LEAKAGE TEST (DECAY TEST USING GN₂) AT 900 +/- 15 PSIG WITH NITROGEN SYSTEM AT A LOWER PRESSURE - ENTIRE PANEL LEAKAGE IS LIMITED TO 11.0 SCCM MAX.

QUALIFICATION TEST - COMPONENT BURST PRESSURE IS 2500 PSIG (2 TIMES OPERATING PRESSURE). SUBJECTED TO THE FOLLOWING AS PART OF THE N₂/O₂ CONTROL PANEL. RANDOM VIBRATION SPECTRUM - 20 TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.03 G²/HZ AT 150 HZ. CONSTANT AT 0.03 G²/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. DESIGN SHOCK - 20G TERMINAL SAWTOOTH PULSE OF 11 MS DURATION IN EACH DIRECTION OF THREE ORTHOGONAL AXES. ATP TO VERIFY LEAKAGE IS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

IN-VEHICLE TESTING - INTERNAL LEAK TEST IS PERFORMED AT 925 - 950 PSIG, 10 SCCM MAX LEAKAGE.

OMRSD - SYSTEM LEAK TEST IS PERFORMED WITH 1.88 VALVE CLOSED BEFORE THE FIRST REFLIGHT OF EACH ORBITER AND AT INTERVALS OF FIVE FLIGHTS; MAX ALLOWABLE SYSTEM LEAKAGE IS 70 SCCM. INFLIGHT CHECKOUT DURING EACH MISSION WILL VERIFY NO GROSS INTERNAL LEAKAGE.

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(C) INSPECTION:

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

CONTAMINATION CONTROL
CLEANLINESS LEVEL 200A PER MA0110-301 VERIFIED BY INSPECTION.

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

NONDESTRUCTIVE EVALUATION
INSPECTION OF WELDS BY 20X VISUAL EXAM, X-RAY AND PENETRANT.

CRITICAL PROCESSES
PARTS PASSIVATION AND ANODIZING VERIFIED BY INSPECTION. HEAT TREATMENT
VERIFIED BY INSPECTION. SOLDER CONNECTIONS VERIFIED BY INSPECTION TO BE
PER NHBS300.4(3A). POTTING VISUALLY VERIFIED BY INSPECTION. APPLICATION OF
LUBRICANT ON SEAL RING VERIFIED BY INSPECTION. TIG WELD SCHEDULE 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 INTERNAL LEAKAGE FAILURE MODE. THE
ISOLATION VALVE (1.88) HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE
PROGRAM CONSIDERING THIS FAILURE MODE.

(E) OPERATIONAL USE:
NO CREW ACTION REQUIRED FOR FIRST FAILURE.

- APPROVALS -

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

Handwritten signature and date:
35026DE
1/12/94