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PRINT DATE: 08/27/93

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE
NUMBER: 06-1C-0111-X

SUBSYSTEM NAME: ARS - ARPCS

REVISION: 4 08/26/93

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: N2/O2 CONTROL PANEL CARLETON TECHNOLOGIES	MC250-0002-1001 2720-0001
SRU	: VALVE, SOLENOID, OXYGEN	2722-0001-9

PART DATA

QUANTITY OF LIKE ITEMS: 2
ONE PER LOOP
TWO PER SUBSYSTEM

FUNCTION:
SOLENOID VALVE OXYGEN SYSTEM SELECTOR (1.19)

PROVIDES VALVING FOR THE TRANSFER OR ISOLATION OF AUXILIARY OXYGEN TO EITHER SYSTEM ONE OR SYSTEM TWO OXYGEN LOOPS, AND THE FLOW OF OXYGEN FROM PRSD CRYO SYSTEM TO THE LAUNCHENTRY SUITS (LES) AND AIRLOCK SYSTEMS. BOTH VALVES MUST REMAIN OPEN TO PROVIDE SUFFICIENT OXYGEN FLOW FOR LES USE. PROVIDES FOR CROSS TRANSFER OF PRSD OXYGEN TO EITHER OF THE ARPCS OXYGEN LOOPS. THE TRANSFER OF AUXILIARY OXYGEN IS APPLICABLE ONLY WHEN THE AUXILIARY OXYGEN TANK IS INSTALLED. 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.

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SHUTTLE CRITICAL ITEMS LIST - ORBITER

NUMBER: 06-10²-0111-02

REVISION# 2 01/09/90

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

CRITICALITY OF THIS
FAILURE MODE:1,1

FAILURE MODE:
INABILITY TO OPEN, RESTRICTED FLOW
AUX O2 TANK NOT INSTALLED

MISSION PHASE:
PL PRELAUNCH
LD 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, CONTAMINATION, ELECTRICAL
FAILURE, PHYSICAL BINDING/JAMMING

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)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
REDUCED SYSTEM OPERATIONAL OPTIONS. LOSS OF CROSS-TIE CAPABILITY
BETWEEN CRYO SUPPLY LINES.

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(B) INTERFACING SUBSYSTEM(S):
LOSS OF ONE O2 SOURCE TO AIRLOCK AND LES.

(C) MISSION:
POSSIBLE EARLY MISSION TERMINATION AS ONLY ONE OXYGEN SOURCE REMAINS FOR CABIN, AIRLOCK AND LES REQUIREMENTS.

(D) CREW, VEHICLE, AND ELEMENT(S):
ONE VALVE FAILED CLOSED RESULTS IN INSUFFICIENT OXYGEN FLOW TO LES SYSTEM. LOSS OF THIS EMERGENCY SYSTEM MAY RESULT IN LOSS OF CREW/VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
NONE

- DISPOSITION RATIONALE -

(A) DESIGN:
VALVE BODY IS MADE OF 6061-T651 ALUMINUM ALLOY ANODIZED FOR CORROSION RESISTANCE. FITTINGS ARE MADE OF 17-4 PH CONDITION A CRES AND 316 CRES CONDITION A. TYPE 316 IS A STANDARD GRADE STAINLESS STEEL WHICH OFFERS THE BEST CORROSION RESISTANCE OF THE STANDARD AUSTENITIC GRADES. 17-4 PH IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL WHICH HAS A HIGH STRENGTH TO WEIGHT RATIO. STATIC SEALS ARE MADE OF SILASTIC 675 SILICONE RUBBER. SILASTIC 675 SILICONE RUBBER HAS GOOD RESISTANCE TO ENVIRONMENTAL EXPOSURE, FLEXING AND FATIGUE. IT ALSO HAS LOW FLAMMABILITY AND OUTGASSING. A NICKEL BELLOWS IS UTILIZED AS A DYNAMIC SEAL WHICH CONSIDERABLY REDUCES FRICTION, STICKING, AND WEAR. THE INLET AND OUTLET PORTS ARE FILTER PROTECTED WITH 25 MICRON ABSOLUTE FILTERS. GUIDE RINGS ARE MADE OF TEFLON; METAL-TO-METAL CONTACT WITH RESULTANT CONTAMINANT PROBLEMS IS ELIMINATED.

(B) TEST:
ACCEPTANCE TEST - ATP ON VALVE INCLUDES PROOF TEST AT 1875 PSIG (1.5 TIMES MAXIMUM OPERATING PRESSURE). EXTERNAL LEAK TESTED FOR 0.2 SCCM MAX LEAKAGE AT 1250 PSIG. INTERNAL LEAK TESTED FOR 1.0 SCCM MAX LEAKAGE AT 900 PSIG FOR A MINIMUM OF 2 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 +/- 25 PSIG WITH NITROGEN SYSTEM AT A LOWER PRESSURE - ENTIRE PANEL LEAKAGE IS LIMITED TO 11.0 SCCM MAX. FLOW TEST AT AN INLET PRESSURE OF 200-202 PSIG AND A FLOW OF 75 LB/HR.

QUALIFICATION TEST - LIFE CYCLE TESTING THE VALVE WAS SUBJECTED TO 50 OPEN/CLOSE CYCLES AT 900 PSIG, PRECEDING AND FOLLOWING WHICH INTERNAL LEAKAGE TESTING WAS CONDUCTED. COMPONENT BURST PRESSURE IS 2500 PSIG

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(2 TIMES MAXIMUM 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 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. DESIGN SHOCK - 2CG 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.

CMRSD - 1.19 VALVES ARE VERIFIED OPEN IN 12 CHECK VALVE LEAKAGE CHECK 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

CLEANLINESS LEVEL 200A PER MAQ110-301 VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

TORQUES VERIFIED AND SPRING FORCES VERIFIED BY INSPECTION. TIG WELD SCHEDULE. DIMENSIONAL CHECKS PERFORMED BY INSPECTION. MIPS FOR CONCENTRICITY AND PERPENDICULARITY. 20X VISUAL INSPECTION ON SEAL RING VERIFIED.

NONDESTRUCTIVE EVALUATION

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

CRITICAL PROCESSES

PARTS PASSIVATION, ANODIZING AND HEAT TREATMENT VERIFIED. SOLDER CONNECTIONS VERIFIED BY INSPECTION IN ACCORDANCE WITH SPECIFICATION NH85300.4(3A). POTTING VISUALLY INSPECTED BY INSPECTION. APPLICATION OF LUBRICANT ON SEAL RING VERIFIED BY INSPECTION. ELECTRO DEPOSITED NICKEL APPLICATION VERIFIED BY INSPECTION.

TESTING

ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE AND SHIPPING PROCEDURES ARE VERIFIED.

(D) FAILURE HISTORY:

NO FAILURE HISTORY.

(E) OPERATIONAL USE:

IBS.

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- APPROVALS -

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