FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: 06-1A-1631-X

SUBSYSTEM NAME: ARS - AIRLOCK
REVISION : 2 09/21/90

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	ISOLATION VALVE, VACUUM VENT CARLETON TECHNOLOGIES	MC250-0002-0100 2710-0001-1

PART DATA

- EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

- QUANTITY OF LIKE ITEMS: 1

- FUNCTION:
  PROVIDES CAPABILITY TO ISOLATE THE TWO INCH AIRLOCK DEPRESSURIZATION LINE AT THE XO 576 BULKHEAD TO PRECLUDE A SINGLE FAILURE FROM DEPRESSURIZING THE CABIN. VALVE HAS A BLEED HOLE (3 LB/HR) FOR H2 SEPARATOR AND WCS VENTING.

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SUBSYSTEM: ARS - AIRLOCK
LRU :ISOLATION VALVE, VACUUM VENT
ITEM NAME: ISOLATION VALVE, VACUUM VENT

CRITICALITY OF THIS FAILURE MODE:1R2

■ FAILURE MODE:
FAILS CLOSED

MISSION PHASE:
OO ON-ORBIT
DO DE-ORBIT

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

■ CAUSE:
MECHANICAL SHOCK, VIBRATION, CONTAMINATION, ELECTRICAL SHORT/OPEN

■ 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:
INABILITY TO PROVIDE VACUUM VENTING

■ (B) INTERFACING SUBSYSTEM(S):
LOSS OF NORMAL AIRLOCK DEPRESSURIZATION CAPABILITY. WHEN RCRS IS INSTALLED, REGENERATION OF ADSORBENT BEDS IS NOT POSSIBLE. LOSS OF USE OF THE RCRS.

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■ (C) MISSION:
NONE FOR FIRST FAILURE. EDO MISSIONS - EARLY MISSION TERMINATION. LIOH CANISTERS MUST BE USED UNTIL LANDING.

■ (D) CREW, VEHICLE, AND ELEMENT(S):
SECOND ASSOCIATED FAILURE (RESTRICTED FLOW OF THE VACUUM BLEED ORIFICE), WILL RESULT IN AN EXPLOSIVE MIXTURE OF H2/O2; POSSIBLE LOSS OF CREW OR VEHICLE.

■ (E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

■ (A) DESIGN:
THE ISOLATION VALVE IS A MOTOR DRIVEN BUTTERFLY VALVE WHICH IS DRIVEN THROUGH AN ECCENTRIC FORK ARRANGEMENT THAT ALSO ACTUATES TWO MICRO-SWITCHES FOR POSITIVE POSITION FEEDBACK. THE MOTOR COMPRISES A DC MOTOR, SLIP CLUTCH, AND PLANETARY REDUCTION GEAR TRAIN. THE BUTTERFLY UTILIZES AN OFFSET SHAFT TO ENABLE A FULL 360 DEGREE SEAL WITH THE VALVE BORE.

THE BORE AREA IS TEFLON IMPREGNATED AND HARD ANODIZED TO MINIMIZE FRICTION AND PROVIDE THE GREATEST CORROSION PROTECTION. VALVE STEM THRUST BEARINGS ELIMINATE LONGITUDINAL RUNOUT, ENSURING THAT THE CENTER LINE OF THE VALVE STEM RUNS THROUGH THE CENTER LINE OF THE BORE, THUS ELIMINATING OVERSTRESSING OF THE VALVE SEAL. THE VALVE BODY IS FABRICATED OF 6061-T6 ALUMINUM WITH A THICKNESS OF 0.05 INCH.

CONTAMINATION PROTECTION: DUAL DEBRIS SCREENS ON INLET OF AIRLOCK DEPRESSURIZATION VALVE MADE OF 6 MESH/INCH 304 CRES WIRE CLOTH. ONE SCREEN IS REMOVABLE SHOULD BLOCKAGE OCCUR DUE TO FROST. WCS COMMODE AND WET TRASH BAG LINERS ARE MADE OF PELLON FABRIC WHICH ACTS AS A 40 MICRON ENTRAPMENT FILTER. ALSO, THE WET TRASH VENT ORIFICE IS AN AXIAL VISCO JET WHICH PRECLUDES LONGITUDINAL CONTAMINANT FLOW THROUGH THE ORIFICE.

■ (B) TEST:
QUALIFICATION TESTS FOR 100 MISSION LIFE: SINUSOIDAL VIBRATION - 5 TO 35 HZ AT +/- 0.25 G PEAK PER AXIS. RANDOM VIBRATION - 0.09 G**2/HZ FOR 48 MINUTES PER AXIS. DESIGN SHOCK - 20 G PER AXIS. ACCELERATION OF 5 G IN EACH DIRECTION ALONG EACH OF THREE MUTUALLY PERPENDICULAR AXES. THE ACCELERATION WAS MAINTAINED FOR 5 MINUTES IN EACH OF THE SIX DIRECTIONS. BURST PRESSURE - OPENED VALVE WAS SUBJECTED TO AN OUTLET PRESSURE LEVEL OF LESS THAN 0.3 PSIA CONCURRENT WITH AN OUTSIDE PRESSURE OF 18 PSIG FOR 5 MINUTES.

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ACCEPTANCE TEST - THE VALVE WAS PROOF PRESSURE TESTED TO 24 PSIG FOR 5 MINUTES. LEAK CHECKED AT 15 PSIG, 1.0 CCM MAXIMUM.

OMRSD - VACUUM VENT ISOLATION VALVE FUNCTIONAL VERIFICATION EVERY FIVE FLIGHTS. VALVE CYCLED EVERY TURNAROUND. NITROGEN PURGE OF DUCT POST- AND PRE-MISSION VERIFIES BLEED PORT IS NOT BLOCKED.

■ (C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIAL VERIFIED.

CONTAMINATION CONTROL
CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN VERIFIED BY INSPECTION. CLEAN LEVELS AND 100 ML RINSE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MANUFACTURING PROCESSES, INSTALLATION AND ASSEMBLY VERIFIED BY INSPECTION. DIMENSIONAL CHECKS PERFORMED BY INSPECTION. VISUAL INSPECTION USING 10X MAGNIFICATION ON SEAL RING VERIFIED BY INSPECTION. LUBRICANT APPLICATION ON SEAL RING VERIFIED BY INSPECTION. TORQUE IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
PASSIVATED PARTS VERIFIED BY INSPECTION. SPECIAL TEFLON IMPREGNATED ANODIZATION (NITUFF) VERIFIED BY INSPECTION. SOLDERING VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
LEAK TEST IS VERIFIED BY INSPECTION

TESTING
ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PARTS PROTECTION VERIFIED BY INSPECTION.

■ (D) FAILURE HISTORY:
NO FAILURE HISTORY.

■ (E) OPERATIONAL USE:
ON ORBIT WORKAROUND VENTS HYDROGEN THROUGH WASTE WATER DUMPLINE UTILIZING IFM CONTINGENCY CROSS-TIE HOSE CONNECTED BETWEEN THE WCS AND CONTINGENCY CROSS-TIE WASTE QUICK DISCONNECT. FOR EDO MISSIONS, INSTALLATION OF LIOH CANISTERS IS REQUIRED UNTIL LANDING. FOR MANDATORY EVA MISSIONS, DEPRESSURIZATION OF THE AIRLOCK BY HATCH "B" EQUALIZATION

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VALVES IS REQUIRED.

- APPROVALS -

RELIABILITY ENGINEERING	H. M. TO	DRT	: E. Ochoa
DESIGN ENGINEERING	K. KELLY	KK	:
QUALITY ENGINEERING	M. SAVALA	MS	:
NASA RELIABILITY			: 9/27/90
NASA SUBSYSTEM MANAGER		JPB	: 11/14/90
NASA QUALITY ASSURANCE			: 11/14/90