

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 XD 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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NUMBER: 06-1A-1631-01

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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:
OPEN

MISSION PHASE:

00 ON-ORBIT
00 DE-ORBIT

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

- CAUSE:
MECHANICAL SHOCK, VIBRATION, CONTAMINATION, ELECTRICAL SHORT

- 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 ISOLATION CAPABILITY OF THE TWO INCH VENT LINE.
- (B) INTERFACING SUBSYSTEM(S):
NO EFFECT. VALVE IS NORMALLY OPEN ON ORBIT.

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NUMBER: 06-1A-1631-01

S050260E
ATTACHMENT -
Page 47 of 96

- (C) MISSION:
NO EFFECT.
- (D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT.
- (E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW/VEHICLE UPON SUBSEQUENT FAILURES:
 - 1) CABIN AIR LEAKAGE INTO VACUUM VENT DUCT, OR
 - 2) FAILURES OF THE RCRS WHICH TIE CABIN AIR DIRECTLY TO VACUUM.

- 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.

(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.

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.

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(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:
NO CREW ACTION REQUIRED FOR FIRST FAILURE.

- APPROVALS -

RELIABILITY ENGINEERING:	D. R. RISING	SRP	: <u>E Ocker</u>
DESIGN ENGINEERING	: K. KELLY	HK	: <u>[Signature]</u> 9/21/90
QUALITY ENGINEERING	: M. SAVALA	MS	: <u>[Signature]</u> 9/27/90
NASA RELIABILITY	:	DRB	: <u>[Signature]</u> 11/14/90
NASA SUBSYSTEM MANAGER	:		: <u>[Signature]</u> 11/14/90
NASA QUALITY ASSURANCE	:		: <u>[Signature]</u> 11/14/90