

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 06-1C-0201 -X

SUBSYSTEM NAME: ARS - ARPCS

REVISION: 8 10/27/98

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	: RV, CABIN POSITIVE PRESSURE CARLETON TECHNOLOGIES	MC250-0002-0250 2655-0001-15

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
CABIN POSITIVE PRESSURE RELIEF VALVE ASSEMBLY (RELIEF AND ISOLATION VALVES)

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 2

FUNCTION:

VALVE HAS TWO SECTIONS WHICH WORK IN SERIES. THE FRONT SECTION IS A MOTOR DRIVEN BUTTERFLY VALVE AND PROVIDES ISOLATION OF THE RELIEF SECTION. THE RELIEF SECTION VENTS AT CABIN PRESSURE BETWEEN 15.5 AND 16.0 PSID TO PREVENT OVER PRESSURIZATION OF THE CABIN AND IS CAPABLE OF FLOWING A MINIMUM OF 150 LB/HR AT 16 PSID. VALVE IS MOUNTED ON THE XO 576 BULKHEAD, WITH A SINGLE O-RING SEAL (REF FMEA 01-4-CS44-1).

- APPROVALS -

EDITORIALLY APPROVED	: BNA	: <u>J. Kimura 10-28-98</u>
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: <u>96-CIL-020_06-1C</u>

PAGE: 11

PRINT DATE: 01/15/91

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 06-1C-0201-03

SUBSYSTEM: ARS - ARPCS
LRU :RV, CABIN POSITIVE PRESSURE
ITEM NAME: RV, CABIN POSITIVE PRESSURE

REVISION# 2 07/18/90 R

CRITICALITY OF THIS FAILURE MODE: 1/1

RI TO VERIFY MAT NAME

FAILURE MODE:
EXTERNAL LEAKAGE (CRACKED MOUNTING FLANGE)

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:
MATERIAL DEFECT, MECHANICAL SHOCK, VIBRATION

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:
EXCESSIVE LOSS OF CABIN ATMOSPHERE.

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NUMBER: 06-1C-0201-03

(B) INTERFACING SUBSYSTEM(S):

INCREASED USE OF N2/O2 MAKE-UP GASES.

(C) MISSION:

ABORT DECISION - MISSION TERMINATION BASED ON MAGNITUDE OF LEAK.

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

POSSIBLE LOSS OF CREW/VEHICLE IF EQUIVALENT HOLE SIZE IS GREATER THAN 0.45 INCH. RETURN REQUIRED WITH EMERGENCY 8.0 PSIA CABIN PRESSURE MAINTENANCE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

(A) DESIGN:

THE ONLY PORTION OF THE VALVE BODY BEING CONSIDERED AS CRITICALITY 1/1 IS THE MOUNTING FLANGE. CRACKS ELSEWHERE IN THE VALVE ARE PROTECTED BY ONE OR MORE REDUNDANT SEALS; E.G. SILASTIC 675 STATIC SEALS, SILICONE SHEET DIAPHRAGM, NICKEL BELLOWS, SILICONE RUBBER POPPET SEAT. THE VALVE BODY IS MADE OF 6061-T6 ALUMINUM, ANODIZED FOR CORROSION RESISTANCE. THE MOUNTING FLANGE PORTION OF THE VALVE BODY IS 0.19 INCH THICK. THE VALVE WEIGHS 2.20 LB. IT IS INSTALLED ON THE XO 576 BULKHEAD OVER THE WCS, BEHIND A CLOSEOUT PANEL WHERE IT CANNOT BE INADVERTENTLY DAMAGED BY PERSONNEL. 32 RMS FINISH ON MOUNTING FLANGE MINIMIZES LEAKAGE AT BULKHEAD.

(B) TEST:

ACCEPTANCE TEST - PER ATP 2655-5. PROOF PRESSURE 24.5 - 25.5 PSIG. INTERNAL AND EXTERNAL LEAKAGE TEST AT 15 +/- .15 PSIG, 15 SCCM MAX LEAKAGE.

QUALIFICATION TEST - PER QTP 2655-5. BURST PRESSURE 32 PSIG (FACTOR OF SAFETY = 2). DESIGN SHOCK - 20G TERMINAL SAWTOOTH PULSE OF 11 MS DURATION IN EACH DIRECTION OF THREE ORTHOGONAL AXES. RANDOM VIBRATION SPECTRUM - 20 TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.09 G**2/HZ, CONSTANT AT 0.09 G**2/HZ FROM 150 TO 900 HZ, DECREASING AT 9 DB/OCTAVE FROM 900 TO 2000 HZ FOR 48 MINUTES PER AXIS. SINUSOIDAL VIBRATION - 5 - 35 HZ AT +/- 0.25 G PEAK IN THREE ORTHOGONAL AXES; DURATION CONTROLLED BY A ONE OCTAVE PER MINUTE SWEEP RATE. THERMAL VACUUM TEST WAS PERFORMED AT 1 PSIA MAX. TEMPERATURE WAS CYCLED BETWEEN -65 F AND +200 F AND LEAKAGE MEASURED; MAX LEAKAGE 15 SCCM. OPERATING LIFE - 200 RELIEF VALVE CRACK/RESEAT CYCLES. ATP TO VERIFY LEAKAGE IS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

PAGE: 13

PRINT DATE: 01/16/91

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 06-1C-0201-03

IN-VEHICLE TESTING - 3.2 PSID CABIN LEAK TEST.

CMRSD - 3.2 PSID CABIN LEAK TEST PERFORMED BEFORE FIRST REFLIGHT OF EACH ORBITER. A 2 PSID CABIN INTEGRITY TEST IS PERFORMED BEFORE EACH LAUNCH. FLIGHT DATA WILL BE UTILIZED DURING EACH MISSION TO ASSESS OCCURRENCE OF ANY EXCESSIVE EXTERNAL LEAKAGE.

(C) INSPECTION:

RECEIVING INSPECTION

RAW MATERIAL IS 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 MA110-301 AND 100 ML RINSE 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.

CRITICAL PROCESSES

SOLDERING OF DEBRIS SCREEN IS VERIFIED BY INSPECTION. HEAT TREAT AND ANODIZING ARE VERIFIED BY INSPECTION. LUBRICANT APPLICATION ON SEAL RING VERIFIED BY INSPECTION. POTTING VISUALLY VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

LEAK TEST IS VERIFIED BY INSPECTION.

TESTING

ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

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

(D) FAILURE HISTORY:

NO FAILURE HISTORY APPLICABLE TO EXTERNAL LEAKAGE FAILURE MODE. THE RELIEF VALVE HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM FOR THIS FAILURE MODE.

(E) OPERATIONAL USE:

1. CREW ACTION

PERFORM CREW MODULE LEAK TROUBLESHOOTING AND APPROPRIATE FOLLOW-UP ACTION (E.G. POWERDOWN).

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2. TRAINING

STANDARD ECLSS TRAINING COVERS THE EFFECT OF DECREASING CABIN PRESSURE AND THE NECESSARY ACTION DICTATED BY THE SIZE OF THE LEAK (E.G. POWER-DOWN, MISSION TERMINATION).

3. OPERATIONAL CONSIDERATION

- A. TIME REMAINING IN MISSION IS PROPORTIONAL TO THE N2 QUANTITY REMAINING ON BOARD AND LEAK RATE.
- B. REFERENCE LOSS/FAILURE FLIGHT RULES.
- C. CURRENT FLIGHT DATA FILE PROCEDURES PROPERLY COVER THIS FAILURE AND FOLLOW-UP ACTION.

- APPROVALS -

RELIABILITY ENGINEERING:	D. R. RISING	<i>DRR</i>	:	<i>E. Ocker</i>
DESIGN ENGINEERING	: M. PRICE	<i>MP</i>	:	<i>[Signature]</i>
QUALITY ENGINEERING	: M. SAVALA		:	<i>M. Savala for CSB 4/2/91</i>
NASA RELIABILITY	:	<i>JRB</i>	:	<i>[Signature] 4-2-91</i>
NASA SUBSYSTEM MANAGER	:		:	<i>D.M. [Signature] 4/3/91</i>
NASA QUALITY ASSURANCE	:		:	<i>[Signature] 3/14/91</i>