

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: M7-3A-E4-Y

SUBSYSTEM NAME: TUNNEL ADAPTER - ECLSS

REVISION : 0 01/13/94 W

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	EQUALIZATION VALVE CARLETON TECHNOLOGIES	MC250-0004-0012 2763-0001-9

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
EQUALIZATION VALVE, TUNNEL ADAPTER/SPACELAB HATCH "D".

QUANTITY OF LIKE ITEMS: 2
TWO ON HATCH "D"

FUNCTION:
PROVIDES PRESSURE EQUALIZATION ACROSS THE TUNNEL ADAPTER AND SPACELAB HATCH. EACH VALVE OPERATES INDEPENDENTLY WITH POSITIVE DETENTS AT TWO FLOW POSITIONS. VALVE CAN BE ACTUATED FROM EITHER SIDE OF HATCH.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE

NUMBER: M7-3A-E4-02

REVISION: 0 01/13/94 W

SUBSYSTEM: TUNNEL ADAPTER - ECLSS
 LRU EQUALIZATION VALVE
 ITEM NAME: EQUALIZATION VALVE

CRITICALITY OF THIS
 FAILURE MODE: 1R2

FAILURE MODE:

INABILITY TO CLOSE, INTERNAL LEAKAGE

MISSION PHASE:

OO ON-ORBIT

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

CAUSE:

CONTAMINATION, PHYSICAL BINDING/JAMMING, CORROSION, VIBRATION,
 MECHANICAL SHOCK, POROSITY.

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 PRIMARY SEAL OF ONE EQUALIZATION VALVE.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT - CAP PROVIDES REDUNDANT SEAL.

(C) MISSION:

NO EFFECT.

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

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NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:

SECOND ASSOCIATED FAILURE (INABILITY TO MATE EQUALIZATION VALVE CAP) MAY RESULT IN LOSS OF EVA CREWMAN IF CONTINGENCY EVA IS REQUIRED AND TUNNEL ADAPTER CANNOT BE REPRESSURIZED FOR RETURN TO CABIN (EVA CREWMAN MUST REMAIN IN AIRLOCK UNTIL LANDING).

- DISPOSITION RATIONALE -

(A) DESIGN:

UNIT IS A BUTTERFLY VALVE WITH SILICONE ELASTOMER MOLDED IN PLACE ON THE VALVE, THUS ASSURING A CONTINUOUS UNBROKEN GAS SEAL ACROSS THE EDGE OF THE BUTTERFLY VALVE PREVENTING INTERNAL LEAKAGE. VALVE BORE IS HARD ANODIZED WITH TEFLON IMPREGNATED TO PROVIDE MAXIMUM CORROSION RESISTANCE WITH MINIMUM COEFFICIENT OF FRICTION.

UNIT IS FLANGE MOUNTED WITH A SINGLE SILASTIC-675 SILICONE RUBBER O-RING WHICH COMPENSATES FOR ROUGHNESS OF FLANGE, PREVENTING EXTERNAL LEAKAGE. HOUSING IS FABRICATED OF A356.0-T61 ALUMINUM ALLOY AND IS X-RAYED TO DETECT CRACKS.

(B) TEST:

QUALIFICATION TEST FOR 100 MISSION LIFE: ACCELERATION OF 5 G FOR FIVE MINUTES PER AXIS. SINUSOIDAL VIBRATION - 5 TO 35 HZ AT +/- 0.25 G PEAK PER AXIS. RANDOM VIBRATION - 0.09 G**2/HZ FOR 48 MIN/AXIS. DESIGN SHOCK- 20G PER AXIS. THERMAL VACUUM/THERMAL CYCLE - WITH VALVE CLOSED AND COVER ON, UNIT EXPOSED TO 120 TO 130 F AND VACUUM OF 1 X 10 EXP -6 TORR FOR 24 HOURS. LOW/HIGH TEMPERATURE CYCLE - HELD AT -40 TO -50 F FOR 3 HOURS AND AT +120 TO 130 F FOR 3 HOURS. OPERATING LIFE - OPERATED IN OFF/NORMAL/EMERGENCY POSITIONS WITH 15 PSIG APPLIED FOR 800 CYCLES. LEAKAGE MONITORED DURING OR AFTER THESE TESTS LIMITED TO 5 SCCM MAX. BURST PRESSURE TEST AT 30 PSIG (TWICE OPERATING PRESSURE) FOR 5 MINUTES.

ACCEPTANCE TEST - PROOF PRESSURE 25 PSIG GN2, WITH VALVE OPEN AND CLOSED. LEAK CHECK AT 15 PSIG, 5 SCCM MAX - VALVE OPEN AND CLOSED AND REVERSE LEAKAGE.

OMRSD - TUNNEL ADAPTER VALVES OPENING AND CLOSING TORQUES ARE VERIFIED WHEN TUNNEL ADAPTER IS INSTALLED. INTERNAL LEAK TESTED AT 13-15 PSIG, 25 SCCM MAX LEAKAGE, 3.2 PSID LEAK CHECK PERFORMED AT OFF AFTER TUNNEL ADAPTER INSTALLATION. GROSS LEAKAGE TEST AT 2 PSID BEFORE EACH FLIGHT.

(C) INSPECTION:

RECEIVING INSPECTION
MATERIALS VERIFIED AT RECEIVING INSPECTION. ALUMINUM HOUSING CASTINGS ARE HYDROSTATIC PROOF PRESSURE TESTED AT 32 PSID.

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CONTAMINATION CONTROL
CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN
VERIFIED BY INSPECTION. CLEANLINESS LEVELS OF 200A AND 100 ML RINSE
TESTS VERIFIED.

ASSEMBLY/INSTALLATION
MANUFACTURING PROCESSES, INSTALLATION AND ASSEMBLY VERIFIED BY
INSPECTION. TORQUES VERIFIED BY INSPECTION. DIMENSIONAL CHECKS
PERFORMED BY INSPECTION. INSPECTION PERFORMS MIPS FOR CONCENTRICITY
AND PERPENDICULARITY. O-RINGS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
ALUMINUM HOUSING CASTINGS ARE X-RAYED AND DYE PENETRANT INSPECTED TO
DETECT CRACKS, VERIFIED BY INSPECTION.

CRITICAL PROCESSES
PASSIVATED PARTS AND HEAT TREATMENT VERIFIED BY INSPECTION.
MECHANICAL SOLDERING OF DEBRIS SCREEN VERIFIED BY INSPECTION.
ANODIZATION OF ALUMINUM PARTS VERIFIED BY INSPECTION.

TESTING
ATP VERIFIED BY INSPECTION.

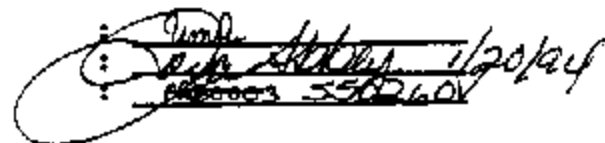
HANDLING/PACKAGING
PARTS PROTECTION VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
(AC2285) DURING LEAK CHECK AFTER INSTALLATION OF HATCH "B" INTO
VEHICLE, SUPER KOROPON PAINT CHIPS IN THE VALVE CAUSED INTERNAL
LEAKAGE. VALVE WAS REMOVED FROM VEHICLE AND REPLACED. CONTAMINATED
VALVE WAS RETURNED TO SUPPLIER, CLEANED AND RETURNED TO STOCK.

(E) OPERATIONAL USE:
NO CREW ACTION REQUIRED IF CAP IS INSTALLED. IF CAP IS NOT INSTALLED,
CREW SHOULD INSTALL CAP AND USE REDUNDANT EQUALIZATION VALVE.

- APPROVALS -

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



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