FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: M7-3A-E7-X

SUBSYSTEM NAME: TUNNEL ADAPTER - ECLSS
REVISION : 1 10/22/92

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	VALVE AND CAP	ME284-0542-0001

PART DATA

- EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
  SPACELAB DUCT ISOLATION VALVE

- QUANTITY OF LIKE ITEMS: 1
  ONE VALVE & ONE CAP

- FUNCTION:
  PROVIDES THE CAPABILITY TO ISOLATE THE TUNNEL ADAPTER FROM THE SPACELAB ATMOSPHERE. THIS ALLOWS DEPRESSURIZATION OF THE TUNNEL ADAPTER FOR EVA, OR FLYING WITH TUNNEL INSTALLED BUT SPACELAB DISCONNECTED. CAP PROVIDES ISOLATION REDUNDANCY. CAP IS NORMALLY INSTALLED FOR ASCENT/ ENTRY AND INSTALLED BY EVA CREWMAN PRIOR TO DEPRESSURIZATION OF THE TUNNEL ADAPTER.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M7-3A-E7-02

REVISION# 1 10/22/92 R

SUBSYSTEM: TUNNEL ADAPTER - ECLSS
LRU :VALVE AND CAP
ITEM NAME: VALVE AND CAP

CRITICALITY OF THIS FAILURE MODE:1R2

■ FAILURE MODE:
INTERNAL LEAKAGE, VALVE/EXTERNAL LEAKAGE, CAP

MISSION PHASE:
OO ON-ORBIT

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

■ CAUSE:
MECHANICAL SHOCK, VIBRATION, CORROSION, CONTAMINATION, POROSITY.

■ CRITICALITY 1/I DURING INTACT ABORT ONLY? NO

■ REDUNDANCY SCREEN A) PASS
■ B) FAIL
■ C) PASS

PASS/FAIL RATIONALE:
■ A)

■ B)
SCREEN B FAILS BECAUSE INTERNAL LEAKAGE OF VALVE IS UNDETECTABLE WHEN AILOCK VENT DUCT CAP IS INSTALLED, ALSO, CAP EXTERNAL LEAKAGE CANNOT BE VERIFIED WHEN VALVE IS OPERATING NORMAL.

■ C)

- FAILURE EFFECTS -

■ (A) SUBSYSTEM:
LOSS OF ONE TUNNEL ADAPTER/SPACELAB ISOLATION CAPABILITY.

■ (B) INTERFACING SUBSYSTEM(S):
NO EFFECT.

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■ (C) MISSION:
NO EFFECT.

■ (D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT.

■ (E) FUNCTIONAL CRITICALITY EFFECTS:
ASSOCIATED FAILURE OF REDUNDANT COMPONENT LEAKAGE (CAP OR VALVE) MAY RESULT IN LOSS OF EVA CREWMEN IF CONTINGENCY EVA IS REQUIRED AND TUNNEL ADAPTER CANNOT BE REPRESSURIZED FOR RETURN TO CABIN (EVA CREWMEN MUST REMAIN IN AIRLOCK UNTIL LANDING).

- DISPOSITION RATIONALE -

■ (A) DESIGN:
THE ISOLATION VALVE IS A MANUALLY OPERATED VALVE WITH POSITIVE LOCKING IN THE FULL OPEN AND FULL CLOSED POSITION. THE BUTTERFLY VALVE HAS SILICONE LIP SEAL MOLDED DIRECTLY TO THE PERIMETER OF THE VALVE PLATE, WHICH PROVIDES A CONTINUOUS UNBROKEN GAS SEAL ACROSS THE EDGE OF THE VALVE. VALVE BODY IS ALUMINUM WHICH HAS TEFLON IMPREGNATED HARD COAT APPLIED TO THE VALVE BORE SEATING AREA; MAXIMUM CORROSION RESISTANCE WITH MINIMUM COEFFICIENT OF FRICTION. CAP IS FABRICATED FROM 6061-T651 ALUMINUM AND IS CORROSION PROTECTED PER MA0608-301. CAP AND VALVE ARE SURFACE TO SURFACE MATE WITH A SILASTIC 675 SILICONE RUBBER SEAL, SEATED IN VALVE O-RING GROOVE TO PROVIDE A CONTINUOUS GAS SEAL ACROSS THE MATING SURFACES. CAP IS HELD IN PLACE BY HAND ACTUATED CLAMP-OVERCENTER LATCH, WHICH IS MADE OF 301 CRES 1/4 HARD PER MIL S-5059.

■ (B) TEST:
QUALIFICATION TESTS FOR 100 MISSION LIFE: ACCELERATION OF 5 G FOR FIVE MINUTES PER AXIS. SINUSOIDAL VIBRATION @ 5 - 35 HZ. AT AN ACCELERATION AMPLITUDE OF +- 0.25 G PEAK PER AXIS. RANDOM VIBRATION AT THE RATE OF 6 DB/OCTAVE FROM 20-150 HZ, CONSTANT AT 0.03 G2/HZ FROM 150-1000 HZ, AND DECREASING AT 6 DB/OCTAVE FROM 1000-2000 HZ FOR A TOTAL DURATION OF 48 MINUTES PER AXIS. DESIGN SHOCK @ 20 G PER AXIS. OPERATING LIFE - OPERATED OPEN/CLOSED POSITIONS WITH PRESSURE OF 14 - 16 PSIG APPLIED FOR 600 CYCLES.

ACCEPTANCE TEST - THE VALVE WAS PROOF PRESSURE TESTED AT 24 PSIG FOR 5 MINUTES WITH VALVE OPEN AND CLOSED. INTERNAL LEAK CHECK AT 16 PSI; 5 SCCM MAX.

OMRSD: INTERNAL LEAK CHECK IS PERFORMED BEFORE FLIGHT. LEAK RATE NOT TO EXCEED 15 SCCM AT 16-18 PSIG.

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■ (C) INSPECTION:
RECEIVING INSPECTION
MATERIALS VERIFIED AT RECEIVING INSPECTION.

CONTAMINATION CONTROL
CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN VERIFIED BY INSPECTION. CLEANLINESS LEVELS OF 300A.

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.

CRITICAL PROCESSES
PASSIVATED PARTS VERIFIED BY INSPECTION. SPECIAL TEFLON IMPREGNATED ANODIZATION (NITUFF) 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 IS REQUIRED FOR FIRST FAILURE.

- APPROVALS -

RELIABILITY ENGINEERING	D. R. RISING	
DESIGN ENGINEERING	S. CASTILLO	
QUALITY ENGINEERING	M. SAVALA	
NASA RELIABILITY		
NASA SUBSYSTEM MANAGER		
NASA QUALITY ASSURANCE		
EDITORIALLY APPROVED	RI	10/22/92
EDITORIALLY APPROVED	JSC	
TECHNICAL APPROVAL	VIA CR	SAD24.0V