PRINT DATE: 08/30/93

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL HARDWARE
NUMBER: 06-1B-0316-X

SUBSYSTEM NAME: ARS -COOLING

REVISION: 4 08/25/93

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	WATER SEPARATOR HAMILTON STANDARD	MC621-0008-0007 SV755513
SRU	:	VALVE: CHECK	SV729703

PART DATA

QUANTITY OF LIKE ITEMS: 4
TWO PER SEPARATOR

FUNCTION:
CHECK VALVE, LIQUID FLOW

ONE OF FOUR VALVES IN TWO WATER SEPARATOR CONDENSATE FLOW PATHS TO PERMIT FLOW OF WATER FROM SEPARATOR TO WASTE TANK AND TO BLOCK REVERSE FLOW THROUGH A NON OPERATING SEPARATOR OR OUT OF WASTE TANK.

PRINT DATE: 08/30/93

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL FAILURE MODE
NUMBER: 06-1B-0316-01

REVISION# 4 08/25/93 R

SUBSYSTEM NAME: ARS - COOLING
LRU: WATER SEPARATOR
ITEM NAME: VALVE, CHECK

CRITICALITY OF THIS FAILURE MODE: 2R3

FAILURE MODE:
OPEN (FAILS TO CHECK)

MISSION PHASE:

LO	LIFT-OFF
OO	ON-ORBIT
DO	DE-ORBIT-

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

CAUSE:
MECHANICAL SHOCK, VIBRATION, CORROSION, CONTAMINATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN
A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)

B)
SCREEN B FAILS BECAUSE, WITH TWO CHECK VALVES IN SERIES, FAILURE OF ONE CHECK VALVE IS NOT DETECTABLE IN FLIGHT.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF REDUNDANT BACK-FLOW PREVENTION IN THE AFFECTED CONDENSATE FLOW PATH.

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

(C) MISSION:
NO EFFECT.

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

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NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:
LOSS OF THE REDUNDANT CHECK VALVE IN THIS FLOW PATH PERMITS BACK-FLOW OF WASTE WATER TO FLOOD THE SEPARATOR AND TO FLOW INTO THE CABIN. HUMIDITY SEPARATION CAPABILITY IS LOST. THE WASTE WATER TANK INLET VALVE MUST BE CLOSED TO STOP BACK-FLOW. POSSIBLE EARLLY MISSION TERMINATION.

-DISPOSITION RATIONALE-

(A) DESIGN:
CHECK VALVE IS A DIAPHRAGM TYPE WHICH IS SPRING-LOADED CLOSED. THE DIAPHRAGM, INCLUDING AN INTEGRAL SEAT SEALING SURFACE, IS MOLDED VITON RUBBER. THE HOUSING AND SPRING CUP ARE 347 CRES AND THE SPRING IS 302 CRES. THE WATER SEPARATOR HAS TWO CHECK VALVES IN SERIES IN EACH WATER EXTRACTION LINE WITH A TEST PORT BETWEEN THE VALVES OF EACH PAIR TO ALLOW INDIVIDUAL VALVE TESTING.

(B) TEST:
ACCEPTANCE TEST - PRIOR TO ASSEMBLY INTO HUMIDITY SEPARATOR - PROOF PRESSURE TESTED WITH WATER AT 70 PSID IN REVERSE DIRECTION. LEAKAGE TESTED WITH GN2 AT 45 PSID IN REVERSE DIRECTION, 0.40 SCCH MAX LEAKAGE. TESTED FOR CRACKING PRESSURE WITH GN2, CRACK AT 5.0 TO 8.5 PSID REQUIRED. TESTING IN HUMIDITY SEPARATOR - LEAKAGE AND CRACKING PRESSURE TESTS REPEATED.

QUALIFICATION TEST - PROOF PRESSURE TESTED AT 67 PSID IN REVERSE DIRECTION WITH WATER. ENDURANCE TESTED FOR 1010 HOURS AT VARYING WATER FLOW RATES. LEAKAGE TESTED AT 5.0 PSID IN FORWARD DIRECTION AND 45 PSID IN REVERSE DIRECTION WITH GN2; FORWARD DIRECTION 28.7 SCCH MAX LEAKAGE, REVERSE DIRECTION 0.4 SCCH MAX LEAKAGE.

OMRSD - CHECK VALVE BACK-LEAKAGE IS TESTED EVERY THIRD FLIGHT. TEST PRESSURE IS 15.5 - 17.0 PSIG; UPSTREAM VALVE (UPSTREAM OF TEST PORT) REQUIREMENT IS 4 SCCM GN2 AND DOWNSTREAM IS 1 CC/HR MAX LEAKAGE. A BLOWDOWN AIR PRESSURE TEST IS CONDUCTED TO COLLECT CONTAMINANTS ON THE SLURPER BAR ON A CONTINGENCY BASIS IF HUMIDITY SEPARATOR AIR FLOW RATE IS LESS THAN 37 LB/HR (AS INDICATED BY AIR FLOW TEST PERFORMED EVERY THIRD FLIGHT). CONDENSATE WATER IS SAMPLED EVERY 5 FLIGHTS TO CHECK FOR MICROBIOLOGICAL GROWTH IN AIR PASSAGES.

(C) INSPECTION:
RECEIVING INSPECTION
CERTIFICATION OF RAW MATERIALS AND PROCESSES IS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
INSPECTION VERIFIES INTERNAL CLEANLINESS TO LEVEL 300 REQUIREMENTS. INSPECTION ALSO VERIFIES THE CONTAMINATION CONTROL PLAN.

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ASSEMBLY/INSTALLATION
THE ASSEMBLY BUILDUP AND APPLICABLE MANUFACTURING PROCESSES ARE VERIFIED BY INSPECTION. DIMENSIONS AND SURFACE FINISHES VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
LEAK CHECK IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
HEAT TREAT IS VERIFIED BY INSPECTION.

TESTING
THE ATP WHICH INCLUDES PROOF PRESSURE, LEAK TESTS, AND CRACKING PRESSURE TESTS IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
CAR 05F018, 01/03/83. CONTAMINATION IN THE HUMIDITY SEPARATOR FAN AND PITOT AREAS DEGRADED THE WATER REMOVAL CAPABILITY. CONTAMINATION OF SEPARATOR CHECK VALVES CAUSED HIGH CRACKING PRESSURE AND CAUSED THE DIAPHRAGM TO FAIL TO SEAT PROPERLY, RESULTING IN LEAKAGE. THE UPSTREAM CHECK VALVE OF SEPARATOR B WAS CONTAMINATED MORE THAN THE DOWNSTREAM CHECK VALVE. SEPARATOR A CHECK VALVES WERE CONTAMINATED TO A LESSER DEGREE.
CORRECTIVE ACTION IMPLEMENTED WAS IMPROVED UPSTREAM FILTRATION (FLIGHT DECK AVIONICS LRU INLET FILTERS AND CABIN FAN DEBRIS TRAP). HUMIDITY SEPARATOR AIR FLOW IS MONITORED PER OMRSD AND A BLOWDOWN OF THE HUMIDITY CONTROL HEAT EXCHANGER IS PERFORMED TO COLLECT CONTAMINANTS WHEN AIRFLOW IS DEGRADED.

(E) OPERATIONAL USE:
1. CREW ACTION
NONE.

2. TRAINING
NONE.

3. OPERATIONAL CONSIDERATIONS
NONE.

- APPROVALS -

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