FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL HARDWARE
NUMBER: 06-1B-0536-X

SUBSYSTEM NAME: ARS - COOLING

REVISION: 4 08/25/93

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	PRI COOL PUMP AND ACCUM HAMILTION STANDARD	MC621-0008-0455 SV755509
LRU	:	SEC COOL PUMP AND ACCUM HAMILTION STANDARD	MC621-0008-0456 SV755509
SRU	:	VALVE, WATER BYPASS CONTROL	SV729725-5

PART DATA

QUANTITY OF LIKE ITEMS: 2

FUNCTION:
REGULATES BYPASS WATER FLOW RATE AROUND FREON INTERCHANGER, AND HUMIDITY CONTROL HEAT EXCHANGER BRANCH DIRECTLY TO THE COOLANT PUMP.

PRINT DATE: 08/30/93

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL FAILURE MODE
NUMBER: 06-1B-0536-02

REVISION# 4 08/25/93 R

SUBSYSTEM: ARS - COOLING
LRU: PRI COOL PUMP AND ACCUM
ITEM NAME: VALVE, WATER BYPASS CONTROL

CRITICALITY OF THIS FAILURE MODE: 1R2

FAILURE MODE:
INABILITY TO CLOSE, INTERNAL LEAKAGE

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, PHYSICAL BINDING/JAMMING

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN
A) PASS
B) N/A
C) PASS

PASS/FAIL RATIONALE:
A)

B)
SCREEN B IS N/A BECAUSE REDUNDANT LOOP IS IN STANDBY UNTIL REQUIRED.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF CAPABILITY TO DIRECT TOTAL COOLANT FLOW THROUGH INTERCHANGER; LOSS OF ONE WATER COOLANT LOOP (INADEQUATE COOLING).

(B) INTERFACING SUBSYSTEM(S):
ELEVATED CABIN TEMPERATURE AND OVERHEATED CABIN AVIONICS IF VALVE FAILS IN FULL BYPASS POSITION. 600 PPH THROUGH INTERCHANGER IS MINIMUM REQUIREMENT.

(C) MISSION:
POSSIBLE EARLY MISSION TERMINATION FOR LOSS OF ONE WATER COOLANT LOOP FOR CABIN AND AVIONICS COOLING.

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(D) CREW, VEHICLE, AND ELEMENT(S):
POTENTIAL LOSS OF CREW/VEHICLE UPON SUBSEQUENT LOSS OF REDUNDANT WATER COOLANT LOOP.

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:
ACTUATOR OPERATED TWO-WAY DIVERTER VALVE WITH A CYLINDRICAL VALVE ELEMENT. HAS REDUNDANT DYNAMIC SEALS USED TO PREVENT WATER LEAKAGE TO AMBIENT. VALVE MATERIAL IS CORROSION AND HEAT RESISTANT STEEL SAE 30347 CONDITION A AND SEALS ARE VITON.

(B) TEST:
ACCEPTANCE TEST - PROOF PRESSURE TESTED AT 135 PSID. LEAKAGE TEST - 5 LB/HR WATER MAX AT 29.6 PSID.

QUALIFICATION TEST - BURST PRESSURE 180 PSID. COLLAPSE PRESSURE 22.5 PSID. PROOF PRESSURE 135 PSID. INTERNAL LEAK RATE REQUIREMENT IS LESS THAN 5 LB/HR AT 29.6 PSID. VIBRATION, SHOCK AND ACCELERATION DONE WITH THE PUMP PACKAGE: 1168 OPEN/CLOSE CYCLES VS 500 CYCLES FOR MISSION REQUIREMENT. SUBJECTED TO RANDOM VIBRATION SPECTRUM ENVELOPE OF 20 TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.03 G**2/HZ, CONSTANT AT 0.03 G**2/HZ FROM 150 TO 1000 HZ, DECREASING AT 6 DB/OCTAVE FROM 1000 TO 2000 HZ FOR 48 MINUTES PER AXIS IN THREE ORTHOGONAL AXES. DESIGN SHOCK - THREE TERMINAL SAWTOOTH PULSES OF 20 G PEAK AMPLITUDE AND 11 MS DURATION APPLIED IN BOTH DIRECTIONS ALONG EACH OF THREE ORTHOGONAL AXES.

OMRSD - BYPASS VALVE MOTION IN MANUAL MODE IS VERIFIED EACH FLIGHT. AUTOMATIC CONTROL OF BYPASS VALVE IS VERIFIED EVERY FIFTH FLIGHT. WATER IS SAMPLED PER SPEC SE-S-0073 DURING SERVICING.

(C) INSPECTION:
RECEIVING INSPECTION
INCOMING PARTS ARE VERIFIED FOR MATERIALS AND PROCESS CERTIFICATION. RECEIVING LOG IS MAINTAINED FOR VERIFICATION.

CONTAMINATION CONTROL
CLEANLINESS REQUIREMENTS VERIFIED BY INSPECTION. CORROSION PROTECTION IS VERIFIED BY INSPECTION. CORROSION PROTECTION PROVISIONS ARE CHECKED.

ASSEMBLY/INSTALLATION
ORIENTATION OF CONNECTOR MASTER KEYWAY IS DETERMINED AND VERIFIED BY INSPECTION. TORQUE APPLIED TO MOUNTING SCREWS IS CHECKED PER DRAWING REQUIREMENT. BOTH COMPONENTS AND ASSEMBLY ARE INSPECTED VISUALLY. SUPER KOROPON TREATED SURFACE OVERCOATED WITH POLYURETHANE IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
LEAK CHECK IS VERIFIED BY INSPECTION.

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CRITICAL PROCESSES
WELD OF THE FILTER HOUSING TO PUMP INLET FLANGES IS VERIFIED. TUBE WELD IS CHECKED TO VERIFY ITS INTEGRITY DURING ASSEMBLY. COMPONENT HEAT TREATMENT IS VERIFIED BY INSPECTION.

TESTING
ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING FOR SHIPMENT IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
NO FAILURE HISTORY APPLICABLE TO INABILITY TO CLOSE FAILURE MODE. THE CONTROL VALVE HAS SUCCESSFULLY PERFORMED WITHOUT FAILURE THROUGH THE DURATION OF THE SHUTTLE PROGRAM.

(E) OPERATIONAL USE:
WATER BYPASS VALVE HAS PROVISIONS FOR MANUAL OVERRIDE BY CREW. THE OVERRIDE DISENGAGES THE MOTOR AND GEAR DRIVE AT THE CLUTCH OUTPUT SHAFT ALLOWING AN OVERRIDE HANDLE TO POSITION THE VALVE MANUALLY.

- APPROVALS -

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