PRINT DATE: 08/25/98

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 06-3A-0602 -X

SUBSYSTEM NAME: ACTIVE THERMAL CONTROL

REVISION: 0 02/04/88

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
LRU	. WATER SPRAY BOILER	MC250-0019 ITEM 61 SV766500-4

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
WATER SPRAY BOILER ASSEMBLY

QUANTITY OF LIKE ITEMS: 3
THREE INDEPENDENT BOILER ASSEMBLIES

FUNCTION:
PROVIDES TRANSFER OF WASTE HEAT FROM ORBITER HYDRAULIC SYSTEM AND AUXILIARY POWER UNIT LUBE OIL SYSTEM UTILIZING LATENT HEAT CAPACITY OF WATER.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE
NUMBER: 06-3A-0602- 03

REVISION#: 1 . 08/25/98

SUBSYSTEM NAME: ATCS - WATER SPRAY BOILER
LRU: WATER SPRAY BOILER ASSEMBLY **CRITICALITY OF THIS**
ITEM NAME: WATER SPRAY BOILER ASSEMBLY **FAILURE MODE:** 1R2

FAILURE MODE:
EXTERNAL LEAKAGE FROM LINES AND FITTINGS, HYDRAULIC OIL

MISSION PHASE: LO LIFT-OFF
DO DE-ORBIT

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

CAUSE:
CORROSION, POROSITY, VIBRATION, MECHANICAL SHOCK

CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES
RTLS RETURN TO LAUNCH SITE

REDUNDANCY SCREEN
A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NO EFFECT

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(B) INTERFACING SUBSYSTEM(S):
POSSIBLE LOSS OF ONE HYDRAULIC SYSTEM DUE TO FLUID DEPLETION. LOSS OF HYDRAULIC CAPABILITY TO THROTTLE ONE MAIN ENGINE, LOSS OF HYDRAULIC LANDING GEAR DEPLOY AND NOSEWHEEL STEERING IF SYSTEM ONE LOST AND LOSS OF ONE OF THREE ET UMBILICAL RETRACT ACTUATORS FOR EACH UMBILICAL PLATE. LOSS OF REDUNDANT HYDRAULIC POWER SYSTEM FOR FOUR TVC ACTUATORS. LOSS OF ONE OF THREE HYDRAULIC POWER SYSTEMS TO FLIGHT CONTROL SURFACES AND BRAKES.

(C) MISSION:
ABORT DECISION - REMAINING TWO SYSTEMS PROVIDE SAFE RETURN.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
FUNCTIONAL CRITICALITY EFFECTS - POSSIBLE LOSS OF CREW/VEHICLE WITH THIS FAILURE PLUS LOSS OF A SECOND APU/HYD SYSTEM. CRIT 1 FOR SSME INDUCED RTLS IF LOSS OF APU/HYD SYSTEM OCCURS DURING MAX Q SSME THROTTLE DOWN PHASE DUE TO THIS WSB FAILURE.

-DISPOSITION RATIONALE-

(A) DESIGN:
LINES AND FITTINGS ARE CONSTRUCTED OF 347 CRES AND ALL JOINTS TO FITTINGS ARE WELDED EXCEPT BYPASS VALVE/HEAT EXCHANGER INTERFACE. DESIGN SAFETY FACTOR - PROOF PRESSURE OF 1.5 AND BURST OF 2.5. NORMAL OPERATING PRESSURE OF HYDRAULIC FLUID LINES AND FITTINGS IS 75 PSIA.

(B) TEST:
QUALIFICATION:
- RANDOM VIBRATION TEST (BOILER & VENT AREA) - ACCELERATION SPECTRAL DENSITY INCREASING AT RATE OF 6 DB/OCTAVE FROM 20 TO 50 HZ; CONSTANT AT 0.01 (G SQ)/HZ FROM 50 TO 2000 HZ FOR 48 MINUTES/AXIS (100 MISSION EQUIVALENCY).
- TEST PERFORMED WITH STORAGE TANK LOADED 100% AND AT MAX OPERATING PRESSURE. HYDRAULIC CIRCUITS PRESSURIZED TO MAX OPERATING PRESSURE THROUGH OUT TEST. PASS/FAIL CRITERIA: NO DAMAGE OR PERMANENT DEFORMATION; NO ELECTRICAL CIRCUIT INTERRUPTIONS DURING TEST.

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- SHOCK TEST-(PER MIL-STD-810, METHOD 516.1, PROCEDURE) 18 SHOCKS TOTAL, 9 EACH AXIS, AT 15 G'S PEAK VALUE FOR 11 MS NOMINAL DURATION WITH FULL WATER LOAD. PASS/FAIL CRITERIA: UNIT MUST PASS SUBSEQUENT PERFORMANCE TESTS.

- PERFORMANCE RECORD TEST-INCLUDES HYDRAULIC CIRCUIT LEAK CHECK.

- THERMAL CYCLE TEST-TESTED AT OPERATING CONDITIONS AT 70 TO 275 TO 70 DEG F WITH DWELL OF 10 MINUTES AT EACH LEVEL FOR 5 CYCLES. ALSO TESTED WITH WSB NOT OPERATING AT 70 TO -65 TO 70 DEG F WITH A DWELL OF 3 HOURS AT EACH LEVEL FOR 3 CYCLES. PASS/FAIL CRITERIA: NO DAMAGE OR PERMANENT DEFORMATION (INCLUDES HYDRALIC LINE/FITTING LEAKAGE).

- PRESSURE IMPULSE TEST - HYDRAULIC CIRCUIT SUBJECTED TO 100,000 PRESSURE CYCLES FROM 0 TO 500 PSIG IN HEAT EXCHANGER MODE. PASS/FAIL CRITERIA: NO HYDRAULIC LEAKAGE.

- HYDRAULIC SECTION BURST TEST-TESTED AT 3750 PSIG FOR 1 MINUTE. PASS/FAIL CRITERIA: NO EVIDENCE OF LEAKAGE.

ACCEPTANCE:
- EXAMINATION OF PRODUCT-VERIFICATION OF WORKMANSHIP, FINISH, DIMENSIONS, CONSTRUCTION, CLEANLINESS, IDENTIFICATION, TRACEABILITY LEVEL AND PROCESSES PER DRAWINGS AND MC250-0019 (WATER SPRAY BOILER PROCUREMENT SPEC).

- HYDRAULIC CIRCUIT PROOF PRESSURE TEST-TESTED FOR 5 MINUTES AT 2250 PSIG WITH HYDRAULIC FLUID. PASS/FAIL CRITERIA: NO EVIDENCE OF PERMANENT DEFORMATION AND PASSAGE OF SUBSEQUENT LEAK CHECKS.

- HYDRAULIC CIRCUIT LEAK CHECK-TESTED FOR 1 HOUR AT 1,500 PSIG WITH HYDRAULIC FLUID. PASS/FAIL CRITERIA: NO VISIBLE EVIDENCE OF EXTERNAL LEAKAGE AND NO PRESSURE DECAY.

- CLEANLINESS-VERIFICATION OF HYDRAULIC SYSTEM CLEANLINESS BY CONTAMINATION SAMPLE UPON COMPLETION OF WSB ATP AND PREP FOR SHIPMENT (HYDRAULIC FLUID - CLEANLINESS LEVEL 190).

GROUND TURNAROUND TEST
- ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIALS ARE VERIFIED BY LAB ANALYSIS. MATERIALS ARE VERIFIED BY INSPECTION PRIOR TO MACHINING.

CONTAMINATION CONTROL
ALL FLUIDS (HYD) ARE SAMPLED FOR CLEANLINESS. CONTAMINATION CONTROL OF HARDWARE IS VERIFIED BY INSPECTION. INTERNAL CLEANLINESS OF HYDRAULIC LINES ARE VERIFIED BY INSPECTION.

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ASSEMBLY/INSTALLATION
MANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. TORQUING PER DRAWING REQUIREMENTS AND CRITICAL DIMENSIONS IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
WELDING, HEAT TREAT, AND PASSIVATION ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
X-RAY AND PENETRANT INSPECTION ARE PERFORMED ON WELDS IN THE ASSEMBLY AND VERIFIED BY INSPECTION.

TESTING
ACCEPTANCE TESTING IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
ABSENCE OF PHYSICAL DAMAGE AND DEFORMATION IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATA BASE.

(E) OPERATIONAL USE:
SHUT DOWN AFFECTED APU/HYD SYSTEM. DELAY SHUTDOWN ON ASCENT IF POSSIBLE TO SUPPORT POWERED FLIGHT PHASE.

- APPROVALS -

EDITORIALLY APPROVED	: BNA	: J. Kimura 8-25-98
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: 95-CIL-009_06-3A