FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 06-3A-0610 -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 ASSEMBLY	MC250-0019 ITEM 612
SRU	: HYDRAULIC BYPASS/RELIEF VALVE	SV766502-2

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
HYDRAULIC BYPASS/RELIEF VALVE

QUANTITY OF LIKE ITEMS: 3
ONE EACH BOILER ASSEMBLY

FUNCTION:
PROVIDES CAPABILITY TO BYPASS THE HYDRAULIC HEAT EXCHANGER SECTION DURING PERIODS WHEN HYDRAULIC COOLING IS NOT REQUIRED AND RELIEF VALVE LIMITS THE PRESSURE DROP ACROSS THE SPRAY BOILER FOR HIGH FLOW CONDITIONS.

FAILURE MODES EFFECTS ANALYSIS FMEA – CIL FAILURE MODE
NUMBER: 06-3A-0610- 03

REVISION#: 1 08/25/98

SUBSYSTEM NAME: ATCS - WATER SPRAY BOILER
LRU: WATER SPRAY BOILER ASSEMBLY **CRITICALITY OF THIS**
ITEM NAME: HYDRAULIC BYPASS/RELIEF VALVE **FAILURE MODE:** 3/3

FAILURE MODE:
RELIEF VALVE FAILS TO OPEN

MISSION PHASE: 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? YES
RTLS RETURN TO LAUNCH SITE

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

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NO EFFECT - HIGH HYDRAULIC SYSTEM FLUID FLOW RATE DEMANDS WILL INCREASE PRESSURE DROP (400 PSID AT 63 GPM AND 208 DEG F) IN WSB HYDRAULIC LOOP WHILE IN HEAT EXCHANGER MODE INCREASED WSB HYDRAULIC LOOP PRESSURE DROP RESULTS IN INCREASED HYDRAULIC RETURN LINE PRESSURE (500 PSIG MAX) AND

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE NUMBER: 06-3A-0610- 03

DECREASED PRESSURE DROP ACROSS AEROSURFACE ACTUATORS. HOWEVER, THIS WILL NOT OVERLY AFFECT AEROSURFACE ACTUATOR PERFORMANCE DURING NOMINAL FLIGHT. PUMP OUTLET PRESSURE WILL REMAIN UNAFFECTED SO SWITCHING VALVES WILL NOT SWITCH TO STANDBY SYSTEM.

(B) INTERFACING SUBSYSTEM(S):
SAME AS (A)

(C) MISSION:
SAME AS (A)

(D) CREW, VEHICLE, AND ELEMENT(S):
SAME AS (A)

(E) FUNCTIONAL CRITICALITY EFFECTS:
NO EFFECT FOR NOMINAL FLIGHT. HOWEVER, CRIT 1 FOR SSME INDUCED RTLS - SUFFICIENT DEGRADATION IN ELEVON ACTUATOR PERFORMANCE WOULD OCCUR WITH WSB IN HEAT EXCHANGER MODE AND RELIEF VALVE FAILED CLOSED DURING IPHASE 5 EVENT OF RTLS TO RESULT IN LOSS OF MISSION, CREW AND VEHICLE. (IPHASE 5 OCCURS AT 14:00 TO 14:40 MET DURING AN "EARLY" RTLS AND 12:20 TO 13:05 MET DURING A "LATE" RTLS.)

-DISPOSITION RATIONALE-

(A) DESIGN:
5 MICRON FILTER IS INCORPORATED INTO THE HYDRAULIC SYSTEM CIRCUIT. THE LENGTH/DIAMETER OF POPPET MINIMIZES BINDING/JAMMING. ALL RELIEF VALVE COMPONENTS ARE COMPATIBLE WITH WORKING FLUIDS. RELIEF VALVE COMPONENT MATERIALS ARE: HOUSING - 347 SS, POPPET - 440C SS, AND GUIDE - TITANIUM. THE RELIEF VALVE, WHICH IS INCORPORATED INTO THE BYPASS VALVE ASSEMBLY, IS A SPRING-LOADED, POPPET-TYPE VALVE WHICH CRACKS AT 49 PSID. ANALYSIS HAS SHOWN THAT A FAILED CLOSED RELIEF VALVE WILL NOT SUFFICIENTLY DEGRADE AEROSURFACE ACTUATOR PERFORMANCE TO CAUSE LOSS OF CREW/VEHICLE.

(B) TEST:

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: 06-3A-0610- 03

QUALIFICATION:
- RELIEF VALVES ARE FUNCTIONALLY TESTED FOR 10,000 CYCLES (CLOSED-OPEN-CLOSED).

- RANDOM VIBRATION TEST (BOILER AND 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 PERCENT AND AT MAXIMUM OPERATING PRESSURE (FULL GN2 PRESSURE). HYDRAULIC AND APU LUBE OIL CIRCUITS PRESSURIZED TO MAX OPERATING PRESSURE THROUGHOUT TEST. PASS/FAIL CRITERIA: NO DAMAGE OR PERMANENT DEFORMATION; NO ELECTRICAL CIRCUIT INTERRUPTIONS DURING TEST.

- SHOCK TEST - (PER MIL-STD-810, METHOD 516.1, PROCEDURE 1) 18 SHOCKS TOTAL, 6 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 RECORD TEST (INCLUDING HYDRAULIC CIRCUIT PROOF AND LEAK CHECKS AND DESIGN POINT CHECK).

- PERFORMANCE RECORD TEST INCLUDES:
  - HYDRAULIC FLOW AND PRESSURE DROP TEST.

ACCEPTANCE:
- BYPASS VALVE COMPONENT TESTED PRIOR TO WSB ASSEMBLY AS FOLLOWS: RELIEF VALVE CRACK TEST (SUBASSEMBLY LEVEL), HOUSING PROOF TESTING, HYDRAULIC LEAKAGE TEST, PERFORMANCE TEST (FLOW VERSUS DELTA P IN BYPASS/HX POSITION).

- EXAMINATION OF PRODUCT - VERIFICATION OF WORKMANSHIP, FINISH, DIMENSIONS, CONSTRUCTION, CLEANLINESS, IDENTIFICATION, TRACEABILTY LEVEL AND PROCESSES PER DRAWINGS AND MC250-0019 (WSB PROCUREMENT SPEC).

- HYDRAULIC FLOW AND PRESSURE DROP TEST-VERIFICATION OF PRESSURE DROP OF HYDRAULIC CIRCUIT AT VARIOUS FLOW RATES AND TEMPERATURES WHILE IN THE HEAT EXCHANGER POSITION AND THE BYPASS POSITION.

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

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIALS ARE VERIFIED BY LAB ANALYSIS. VERIFICATION OF MATERIAL AND EQUIPMENT CONFORMING TO CONTRACTS IS PERFORMED BY INSPECTION.

CONTAMINATION CONTROL
VERIFY INTERNAL CLEANLINESS OF HYDRAULIC LINES PER SPECIFIED REQUIREMENTS. CONTAMINATION CONTROL PROCESSES AND PLANS AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: 06-3A-0610- 03

CRITICAL PROCESSES
WELDING IS VERIFIED BY INSPECTION.

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

NONDESTRUCTIVE EVALUATION
EXAMINATION OF SURFACE WELDS FOR SURFACE AND SUBSURFACE DEFECTS IS VERIFIED BY X-RAY AND DYE PENETRANT INSPECTION.

TESTING
INSPECTION POINTS PERFORMED DURING ATP ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PROPER HANDLING AND STORAGE ENVIRONMENT 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:
NONE

- APPROVALS -

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