

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 06-3A-0606 -X

SUBSYSTEM NAME: ACTIVE THERMAL CONTROL

REVISION: 0 02/04/88

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	: WATER SPRAY BOILER ASSEMBLY	MC250-0019 ITEM 608
SRU	: NITROGEN SHUTOFF VALVE	SV766508-1

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
NITROGEN SHUTOFF VALVE

QUANTITY OF LIKE ITEMS: 3
ONE EACH BOILER ASSEMBLY

FUNCTION:
ELECTRICALLY OPERATED SHUTOFF VALVE TO ISOLATE THE NITROGEN SUPPLY
DURING DORMANT MISSION MODES AND GROUND OPERATION

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 06-3A-0606-02

REVISION#: 1 08/25/98

SUBSYSTEM NAME: ATCS - WATER SPRAY BOILER

LRU: WATER SPRAY BOILER ASSEMBLY

ITEM NAME: NITROGEN SHUTOFF VALVE

CRITICALITY OF THIS

FAILURE MODE: 1R3

FAILURE MODE:

FAILS TO CLOSE OR INTERNAL LEAKAGE

MISSION PHASE: OO ON-ORBIT

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

CAUSE:

**MECHANICAL SHOCK, VIBRATION, CORROSION, PHYSICAL BINDING/JAMMING,
CONTAMINATION, ELECTRICAL SHORT, DAMAGED SEAT**

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN	A) PASS
	B) FAIL
	C) PASS

PASS/FAIL RATIONALE:

A)

B)

**"B" SCREEN FAILS SINCE VALVE MSID DOES NOT INDICATE TRUE VALVE POSITION ALSO,
NORMAL REGULATOR LOCKUP ISOLATES THE GN2 FLOW AND WOULD MASK THIS
FAILURE.**

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE

NUMBER: 06-3A-0606-02

NO EFFECT. POSSIBLE LOSS OF CAPABILITY TO PROVIDE THERMAL CONTROL IN ONE APU/HYD SYSTEM IF A SECOND FAILURE RESULTS IN N2 SYSTEM LEAKAGE. REMAINING TWO SYSTEMS PROVIDE SAFE RETURN AFTER SECOND FAILURE.

(B) INTERFACING SUBSYSTEM(S):

SAME AS (A).

(C) MISSION:

SAME AS (A).

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

NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE WITH THREE FAILURES: THIS FAILURE, PLUS DOWNSTREAM GN2 RELIEF VALVE FAILING OPEN, AND LOSS OF AN ADDITIONAL APU/HYD SYSTEM.

-DISPOSITION RATIONALE-

(A) DESIGN:

10 MICRON FILTER IS INCORPORATED AT THE INLET TO EACH NITROGEN SHUTOFF VALVE. BI-FILAR WOUND SOLENOID WINDINGS PERMIT VALVE ACTUATION FROM EITHER CONTROLLER AND THE VALVE IS MAGNETICALLY LATCHED IN THE OPEN OR CLOSED POSITION. THE VALVE INCORPORATES A VESPEL POPPET ACTING ON A STEEL SEAT. VALVE HOUSING IS MADE UP OF 304L/17-4PH STAINLESS STEEL.

(B) TEST:**QUALIFICATION:**

- COMPONENT LEVEL TEST-LIFE CYCLE TEST (2000 OPERATIONAL CYCLES).
- ELECTRICAL POWER CHECK-VERIFICATION OF ELECTRICAL FUNCTIONAL OF GN2 VALVE.
- GN2 SHUTOFF VALVE LOW VOLTAGE TEST-VERIFICATION OF MAX PULL IN VOLTAGE OF 18 VDC.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: 06-3A-0606- 02**

- 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% AND AT MAX 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 TESTS.

ACCEPTANCE:

- GN2 SHUTOFF VALVE COMPONENT TESTED PRIOR TO WSB ASSEMBLY AS FOLLOWS: PROOF TESTED, LEAK CHECKED (INTERNAL/EXTERNAL). PLUS VERIFICATION OF MAX PULL IN VOLTAGE OF 18 VDC.
- 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).
- HIGH SIDE NITROGEN PROOF PRESSURE TEST-TESTED AT 4770 PSIG FOR 15 MINUTES MINIMUM WITH HELIUM AND WITH CIRCUIT RELIEF VALVE PREVENTED FROM OPENING. PASS/FAIL CRITERIA: NO EVIDENCE OF PERMANENT DEFORMATION AND PASSAGE OF SUBSEQUENT WATER AND NITROGEN CIRCUIT LEAK CHECKS.
- HIGH SIDE NITROGEN LEAK CHECK-TEST AT 3180 PSIG WITH HELIUM AND WITH CIRCUIT RELIEF VALVE PREVENTED FROM OPENING. PASS/FAIL CRITERIA: 2.8 SCCM MAX HELIUM LEAKAGE.
- ELECTRICAL POWER CHECK-INCLUDES ELECTRICAL FUNCTIONAL CHECK OF NITROGEN SHUTOFF VALVE.
- LOW VOLTAGE GN2 VALVE ACTUATION TEST-VERIFICATION OF AUDIBLE VALVE ACTUATION AT 24 VDC (APPLIED AT CONTROLLER).

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

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 06-3A-0606-02**

CLEANLINESS OF NITROGEN LINES IS VERIFIED BY INSPECTION. CONTAMINATION CONTROL PROCESSES AND PLANS AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

TORQUING PER DRAWING REQUIREMENTS IS VERIFIED BY INSPECTION. MANUFACTURING, INSTALLATION, AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. PART PROTECTION, COATING, AND PLATING ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES

WELDING 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 ACCEPTANCE TESTING ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PROPER HANDLING AND STORAGE ENVIRONMENT ARE 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:

ASCENT: NONE

ENTRY: SHUTDOWN AFFECTED APU/HYD SYSTEM OR DELAY APU START IF FAILURE IS KNOWN PRIOR TO DEORBIT.

- APPROVALS -

EDITORIALLY APPROVED
TECHNICAL APPROVAL

: BNA
: VIA APPROVAL FORM

: J. Kimura 8-25-98
: 95-CIL-009_06-3A