

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- GIL HARDWARE

NUMBER: 06-3A-0607 -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 609
SRU	: NITROGEN REGULATOR	SV766509-1

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

NITROGEN REGULATOR

QUANTITY OF LIKE ITEMS: 3

ONE EACH BOILER ASSEMBLY

FUNCTION:

PROVIDES NITROGEN UPON DEMAND TO THE WATER STORAGE TANK. A BUILT IN RELIEF VALVE PREVENTS OVER PRESSURIZATION OF SYSTEM DOWNSTREAM OF REGULATOR.

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REVISION#: 1 08/25/98

SUBSYSTEM NAME: ATCS - WATER SPRAY BOILER

LRU: WATER SPRAY BOILER ASSEMBLY

ITEM NAME: NITROGEN REGULATOR

CRITICALITY OF THIS

FAILURE MODE: 1R2

FAILURE MODE:

RELIEF VALVE FAILS CLOSED

MISSION PHASE:

LO LIFT-OFF

DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102 COLUMBIA

103 DISCOVERY

104 ATLANTIS

105 ENDEAVOUR

CAUSE:MECHANICAL SHOCK, VIBRATION, CORROSION, PHYSICAL BINDING/JAMMING,
CONTAMINATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

A) PASS

B) N/A

C) PASS

PASS/FAIL RATIONALE:

A)

B)

"B" SCREEN IS N/A SINCE RELIEF VALVE IS A STANDBY REDUNDANT SYSTEM.

C)

- FAILURE EFFECTS -**(A) SUBSYSTEM:**

NO EFFECT WITH FIRST FAILURE - REGULATOR MAINTAINS PRESSURE.

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(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:
FUNCTIONAL CRITICALITY EFFECT - POSSIBLE LOSS OF CREW/VEHICLE WITH TWO FAILURES: THIS FAILURE, PLUS AN ASSOCIATED GN2 REGULATOR FAILED OPEN WHICH RESULTS IN BOTH OVERPRESSURIZATION OF ASSOCIATED WATER TANK (LOSS OF ASSOCIATED WSB/APU/HYD SYSTEM) AND LOSS OF ADJACENT WATER TANK (LOSS OF SECOND APU/HYD SYSTEM). RUPTURE OF TANK MAY RESULT IN LOSS OF SECOND AND/OR THIRD APU/HYD SYSTEMS.

-DISPOSITION RATIONALE-

(A) DESIGN:
25 MICRON FILTER IS INCORPORATED DOWNSTREAM OF THE REGULATING SECTION OF THE REGULATOR WHICH PROTECTS THE RELIEF VALVE FROM CONTAMINATION. RELIEF VALVE POPPET SPRING IS DESIGNED TO MAINTAIN CONSTANT PRESSURE ON POPPET IN THE CLOSED POSITION AND THE LENGTH/DIAMETER OF POPPET PREVENTS IT FROM COCKING. REGULATOR IS DESIGNED TO PROVIDE AN OUTLET PRESSURE OF 24.5 TO 26 PSIG. THE RELIEF VALVE CRACKING PRESSURE IS 30 PSIG MINIMUM; THE RELIEF VALVE FULL FLOW PRESSURE IS 33.5 PSIG MAXIMUM. RESEAT PRESSURE IS 28 PSIG MINIMUM.

(B) TEST:
QUALIFICATION:

- NITROGEN REGULATORS SUBJECTED TO 10,000 OPERATIONAL CYCLES AT COMPONENT LEVEL.
- 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

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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 N2 LEAK TESTS AND R/V RESEAT).
- PERFORMANCE RECORD TEST INCLUDES:
 - LOW SIDE N2 LEAK CHECK INCLUDES R/V CRACK TEST FOLLOWED BY N2 LEAK CHECK AT 28 PSIG WITH HELIUM. PASS/FAIL CRITERIA: 2.8 SCCM MAX HELIUM LEAKAGE.
- 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 (INCLUDING VALVE FAILURE). UNIT MUST PASS SUBSEQUENT PERFORMANCE TESTS (INCLUDING N2 LEAK TEST AND R/V RESEAT).

ACCEPTANCE:

- RELIEF VALVES ARE TESTED PRIOR TO INSTALLATION INTO REGULATOR ASSEMBLY AS FOLLOWS: RELIEF VALVE PERFORMANCE TESTS (CRACK, RESEAT, AND FULL FLOW TESTS).
- 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).
- LOW SIDE N2 LEAK CHECK - INCLUDES RELIEF VALVE CRACK TEST FOLLOWED BY N2 LEAK CHECK AT 28 PSIG WITH HELIUM. PASS/FAIL CRITERIA: 2.8 SCCM MAX HELIUM LEAKAGE.

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

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

ASSEMBLY/INSTALLATION

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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

X-RAY AND PENETRANT INSPECTION ARE VERIFIED BY 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. THE FAILURE HISTORY DATA PROVIDED BELOW IS NO
 LONGER BEING KEPT UP-TO-DATE.

(AD1676-010) (1988) SN 16 REG DEMONSTRATED HIGH RELIEF VALVE CRACK PRESSURE (
 >40 PSIG) DURING ATP TESTING. (SPEC: 30-33.5 PSIG CRACK). ANALYSIS IS STILL IN
 WORK.

(E) OPERATIONAL USE:

FIRST FAILURE: NONE. SECOND FAILURE: CLOSE GN2 TANK VALVES. APU/HYD SYSTEM
 SHUT DOWN MAY BE REQUIRED FOR SECOND FAILURE.

- APPROVALS -

EDITORIALLY APPROVED
 TECHNICAL APPROVAL

: BNA
 : VIA APPROVAL FORM

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