

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE**  
**NUMBER:04-2-RV02 -X**

**SUBSYSTEM NAME:** AUXILIARY POWER UNIT (APU)

**REVISION:** 1 09/17/98

**PART DATA**

	<b>PART NAME</b>	<b>PART NUMBER</b>
	<b>VENDOR NAME</b>	<b>VENDOR NUMBER</b>
LRU	:RELIEF VALVE WRIGHT COMPONENTS	ME284-0544 0002/0003 11292-1/-2

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

RELIEF VALVE IS IN THE APU FUEL PUMP SEAL CAVITY DRAIN SYSTEM BETWEEN THE BURST DISK AND OVERBOARD VENT AND RELIEVES AT 28 TO 42 PSIA.

**QUANTITY OF LIKE ITEMS:** 3  
ONE PER APU

**FUNCTION:**

CONTAINS AND RELIEVES THE PRESSURE AT 28 TO 42 PSIA IN THE APU FUEL PUMP SEAL CAVITY DRAIN SYSTEM IF SUFFICIENT FUEL HAS LEAKED THROUGH THE PUMP SEAL TO CRACK THE OVERBOARD RELIEF VALVE.

**FAILURE MODES EFFECTS ANALYSIS FMEA - CIL FAILURE MODE  
NUMBER: 04-2-RV02-03**

REVISION#: 1 09/02/98

**SUBSYSTEM NAME:** AUXILIARY POWER UNIT (APU)  
**LRU:** RELIEF VALVE  
**ITEM NAME:** RELIEF VALVE

**CRITICALITY OF THIS  
FAILURE MODE:** 1R2

**FAILURE MODE:**  
EXTERNAL LEAK (INTO AFT COMPARTMENT VIA RELIEF VALVE FITTING OR HOUSING)

**MISSION PHASE:** PL PRE-LAUNCH  
LO LIFT-OFF  
OO ON-ORBIT  
DO DE-ORBIT  
LS LANDING/SAFING

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

**CAUSE:**  
CORROSION, CRACKED WELDS

**CRITICALITY 1/1 DURING INTACT ABORT ONLY?** NO

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

**PASS/FAIL RATIONALE:**  
A)  
SNIFF CHECK FOR HYDRAZINE PERFORMED EACH VEHICLE TURNAROUND  
B)  
STANDBY REDUNDANT ITEM.  
C)

**- FAILURE EFFECTS -**

**(A) SUBSYSTEM:**  
NONE FOR THE FIRST FAILURE.

**(B) INTERFACING SUBSYSTEM(S):**  
NONE FOR THE FIRST FAILURE.

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**(C) MISSION:**

POSSIBLE LOSS OF MISSION AND CREW/VEHICLE AFTER 2 FAILURES.

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

POSSIBLE LOSS OF MISSION AND CREW/VEHICLE AFTER 2 FAILURES.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

POSSIBLE LOSS OF CREW/VEHICLE AFTER 2 FAILURES:

(1) INTERNAL LEAKAGE BURST DISK

(2) EXTERNAL LEAKAGE OF THE RELIEF VALVE WOULD ALLOW HYDRAZINE INTO AFT COMPARTMENT WHERE IT COULD BE IGNITED CAUSING LOSS OF CREW/VEHICLE.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**

THE RELIEF VALVE IS AN ABSOLUTE PRESSURE REFERENCED DEVICE CONTAINING A BELLOWS POPPET ASSEMBLY WHICH IS SPRING LOADED CLOSED AND PRESSURE OPENED. THE DOWNSTREAM SIDE OF THE POPPET IS PRESSURE BALANCED SO THAT BACK PRESSURE DOES NOT AFFECT THE VALVE PERFORMANCE CHARACTERISTICS. THE DESIGN IS BASED ON A CRACKING PRESSURE RANGE OF 28 TO 42 PSIA WHICH IS SET BY PRELOADING AND LOCKING THE POPPET ASSEMBLY. THE PRIMARY PURPOSE OF THE RELIEF VALVE IS TO PREVENT DETRIMENTAL PRESSURE BUILDUP IN THE AUXILIARY POWER UNIT (APU) FUEL PUMP DRAIN SYSTEM BY PROVIDING FOR THE OVERBOARD VENTING OF ALL LEAKAGE EFFLUENTS FROM THE FUEL PUMP THAT EXCEED THE HOLDING CAPACITY OF THE DRAIN SYSTEM. BY VENTING EXCESSIVE LEAKAGE EFFLUENTS, THE VALVE PRECLUDES THE INTRODUCTION OF HYDRAZINE INTO THE GEARBOX IF GROSS HYDRAZINE LEAKAGE OCCURS. A PROOF PRESSURE TEST (300 PSI) IS PERFORMED TO CONFIRM NO EXTERNAL LEAKAGE EXISTS.

**(B) TEST:**

THE RELIEF VALVE WAS ACCEPTANCE TESTED FOR LEAKAGE AND FUNCTION PER WRIGHT COMPONENTS PROCEDURE 4-0-385/QVM 8W008.

RELIEF VALVE PERFORMANCE WAS VERIFIED DURING QUALIFICATION TESTING.

**GROUND TURNAROUND TEST**

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH QMRSD.

**(C) INSPECTION:**

IDENTIFICATION AND GENERAL APPEARANCE ARE VERIFIED AT RECEIVING.

CONTAMINATION CONTROL

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FLUID SAMPLES ARE ANALYZED FOR CONTAMINATION AND VERIFIED CLEAN TO LEVEL 100 BY INSPECTION. CORROSION RESISTANT MATERIALS ARE USED IN CONSTRUCTION OF THE RELIEF VALVE.

**ASSEMBLY/INSTALLATION**

MANUFACTURING, ASSEMBLY, AND INSTALLATION REQUIREMENTS ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION.

**TESTING**

CALIBRATION OF TOOLS AND TEST EQUIPMENT IS VERIFIED BY INSPECTION. ATP IS WITNESSED AND VERIFIED BY INSPECTION.

**HANDLING/PACKAGING**

HANDLING, PACKAGING, AND SHIPPING PROCEDURES ARE VERIFIED.

**(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:**

POST MECO, CLOSE ISOLATION VALVES.

**- APPROVALS -**

SS & PAE MANAGER	FD: D. F. MIKULA
SS & PAE ENGINEER	: K. E. RYAN
VEHICLE & SYSTEMS DESIGN	: M. A. WEISER
BNA SSM	: T. FARKAS, JR.
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