

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 04-2-CL1A -X**

SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

REVISION: 0 09/17/98

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
	: FUEL SUPPLY	
SRU	: FLEX HOSE TITFLEX	ME271-0079-58XX 106056-58XX

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
FLEX HOSE, FUEL (DRAIN LINES)

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 3
ONE PER DRAINLINE

FUNCTION:
PROVIDES FOR DEFLECTION AT THE APU INTERFACE CAUSED BY APU AND BULKHEAD
VIBRATION AND APU OVERHANG.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 04-2-CL1A-11

REVISION#: 1 09/17/98

SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

LRU: FLEX HOSE

ITEM NAME: FLEX HOSE

CRITICALITY OF THIS
FAILURE MODE: 1/1

FAILURE MODE:
EXTERNAL LEAKAGE

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:
RUPTURE, CRACKS, FITTING FAILURES

1

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 04-2-CL1A-11**

POSSIBLE LOSS OF ONE APU SYSTEM BEFORE MISSION COMPLETION IF EXTERNAL LEAKAGE OCCURS. POSSIBLE LOSS OF ADJACENT AND/OR REDUNDANT APU HARDWARE DUE TO FIRE OR CHEMICAL ATTACK.

(B) INTERFACING SUBSYSTEM(S):

POSSIBLE LOSS OF SHAFT POWER TO ONE HYDRAULIC PUMP. POSSIBLE LOSS OF ADJACENT AND/OR REDUNDANT HARDWARE DUE TO FIRE OR CHEMICAL ATTACK.

(C) MISSION:

ABORT DECISION REQUIRED IF FAILURE OCCURS DURING ASCENT. MINIMUM DURATION FLIGHT IS REQUIRED IF LEAK OCCURS ON ORBIT

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

POSSIBLE LOSS OF CREW/VEHICLE IF LEAKING FUEL IS IGNITED OR IF ADJACENT AND/OR REDUNDANT HARDWARE IS LOST DUE TO FIRE OR CHEMICAL ATTACK.

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE IF RELEASED HYDRAZINE IS IGNITED.

-DISPOSITION RATIONALE-

(A) DESIGN:

MATURE HARDWARE USED ON MILITARY AIRCRAFT AND SPACE PROGRAMS. HOSE INNERCORE IS EXTRUDED TFE. REINFORCEMENT IS 304 SS WIRE BRAID. HOSE IS SINGLE BRAID QUALIFIED TO MIL-H-25579.

HOSE-END FITTINGS ARE SS PROGRESSIVE-SWAGED WITH POSITIVE BRAID LOCK AND CONFORM TO MIL-H-25579. ONE HOSE END IS 304L STRAIGHT TUBE (WELDED TO THE SYSTEM) AND THE OTHER END IS 6AL-4V TITANIUM DUAL-SEAL FITTING WITH 8 RMS FINISH.

(B) TEST:

HOSE ASSEMBLY QUALIFICATION - IMPULSE ENDURANCE CYCLING 100,000 CYCLES 0-1875-0 PSI AT 400F IN ACCORDANCE WITH FIG. 3, MIL-H-25579. RATE 70 CYCLES/MIN
BURST PRESSURE - -8 SIZE, 8,000 PSI AT 70F, 6,000 PSI AT 450 DEG F, SUPPLIER
ACCEPTANCE - PROOF PRESSURE 3000.

INTEGRATED SUBSYSTEM TEST WAS USED FOR CERTIFICATION.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: 04-2-CL1A-11**

OMRSD: TOXIC VAPOR CHECKS OF FLEX HOSE AND MECHANICAL FITTINGS ARE PERFORMED EVERY FLOW.

(C) INSPECTION:

RECEIVING INSPECTION

RECEIVING INSPECTION AND CHEMICAL ANALYSIS PERFORMED ON ALL RAW MATERIALS. RECEIVING INSPECTION VERIFIES INCOMING RAW STOCK IS NOT RELEASED TO THE SHOP FOR USE UNTIL A SAMPLE OF THE MATERIAL HAS BEEN CERTIFIED AS ACCEPTABLE BY THE COMPANY METALLURGIST.

CONTAMINATION CONTROL

CLEANLINESS TO LEVEL 100 IS VERIFIED BY INSPECTION. CORROSION PROTECTION REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, ASSEMBLY AND INSTALLATION REQUIREMENTS ARE VERIFIED BY INSPECTION. DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. HOSE END FITTINGS ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

RADIOGRAPHIC INSPECTION OF SWAGED FITTINGS TO ASSURE THE HOSE AND BRAID ARE PROPERLY BOTTOMED IN THE END FITTING IS VERIFIED. RADIOGRAPHIC INSPECTION OF BUTT WELDED TUBING IS VERIFIED. EACH WELD RADIOGRAPH IS INSPECTED UNDER MAGNIFICATION TO ASSURE THE WELDS ARE FREE OF CRACKS, POROSITY INCLUSIONS OR VOIDS.

CRITICAL PROCESSES

BUTT WELDING AND SWAGING ARE VERIFIED BY INSPECTION.

TESTING

TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. PROOF PRESSURE AND LEAK TEST OF EACH HOSE ASSEMBLY IS PERFORMED BY INSPECTION PERSONNEL

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE, AND SHIPPING PROCEDURES ARE VERIFIED.

(D) FAILURE HISTORY:

CAR AB5521 NOV 1979 AFTER FIRST INSTALLATION IN OV-102, THE FUEL FEED LINE FLEX HOSE DYNATUBE FITTING HAD HYDRAZINE LEAKAGE AFTER PASSING GAS LEAK TEST. THE SEALING SURFACE WAS REPOLISHED AND FITTING RETORQUED; CAUSE OF LEAKAGE COULD NOT BE DETERMINED.

IT WAS CONCLUDED THAT INITIALLY, WHEN THE DYNATUBE FITTING HAD EXPERIENCED ABOVE SPEC GAS LEAKAGE, IT SHOULD HAVE BEEN REMOVED AND REINSTALLED PER DRAWING REQUIREMENTS. CORRECTIVE ACTION WAS TO INCORPORATE THIS

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: 04-2-CL1A-11

REMOVAL AND REINSTALLATION PROCEDURE WHEN A DYNATUBE FITTING SHOWS SIGNS OF EXCESSIVE GAS LEAKAGE.

ADDITIONAL 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	: D.F. MIKULA
SS & PAE ENGINEER	: G.T. TATE
VEHICLE & SYSTEMS DESIGN	: M.A. WEISER
BNA SSM	: T. FARKAS JR.
JSC MOD	: MEL FRIANT
JSC NASA SER QA	: D. BEAUGH
USA/SAM	: M.J. BURBARDT

L. Proctor for 9/15/98
to [unclear] 9/15/98
29/9/98 [unclear] 9/15/98
[unclear] 9/18/98
[unclear] 9/21/98
David Beugh 9/21/98
[unclear] 9/21/98