

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE**

NUMBER: 03-1-0432 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1

08/09/00

**PART DATA**

	<b>PART NAME</b>	<b>PART NUMBER</b>
	<b>VENDOR NAME</b>	<b>VENDOR NUMBER</b>
LRU	:LH2 HI POINT BLEED DISCONNECT, 1.5 INCH (GND) UNITED SPACE ALLIANCE - NSLD	MC276-0004-0002
LRU	:LH2 HI POINT BLEED DISCONNECT, 1.5 INCH (ORB) UNITED SPACE ALLIANCE - NSLD	MC276-0004-0003

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

DISCONNECT, HIGH POINT BLEED 1.5 INCH, SELF SEALING, FLIGHT AND GROUND HALF.

VALVE WAS ORIGINALLY DESIGNED AND MANUFACTURED BY FAIRCHILD CONTROLS BUT IS NOW MANUFACTURED BY UNITED SPACE ALLIANCE-NSLD AS AN ALTERNATE PRODUCTION AGENCY.

REFERENCE DESIGNATORS: PD17

QUANTITY OF LIKE ITEMS: 1

**FUNCTION:**

THE DISCONNECT PROVIDES A PATH FOR GH2 TO BLEED OVERBOARD FROM THE HIGH POINT BLEED VALVE (PV22) INTO THE GROUND VENT SYSTEM. BLEED FLOW STARTS AT SLOW FILL AND TERMINATES AT HIGH POINT BLEED VALVE CLOSURE (T-26 SECONDS) ISOLATING THE DISCONNECT FROM THE FEED SYSTEM. DURING T-0 UMBILICAL DISENGAGEMENT, THE DISCONNECT POPPETS CLOSE, PROVIDING A REDUNDANT INHIBIT AGAINST OVERBOARD FLOW (FLIGHT FLOW) AND ISOLATING THE GROUND VENT SYSTEM (GROUND HALF).

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**NUMBER: 03-1-0432-04**

**REVISION#: 1 08/09/00**

**SUBSYSTEM NAME: MAIN PROPULSION**

**LRU: LH2 HI POINT BLEED DISC, 1.5 INCH (ORB)**

**ITEM NAME: LH2 HI POINT BLEED DISC, 1.5 INCH (ORB)**

**CRITICALITY OF THIS**

**FAILURE MODE: 1/1**

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**FAILURE MODE:**

FAILS TO REMAIN OPEN DURING LH2 BLEED OPERATIONS.

**MISSION PHASE: PL PRE-LAUNCH**

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

**CAUSE:**

PIECE PART STRUCTURAL FAILURE OF THE GROUND HALF DISCONNECT

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

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<b>REDUNDANCY SCREEN</b>	A) N/A
	B) N/A
	C) N/A

**PASS/FAIL RATIONALE:**

A)

B)

C)

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

FAILURE OF THE GROUND HALF DISCONNECT CAN CAUSE THE FLIGHT HALF TO SLAM CLOSED. THE FLOW RATE THROUGH THE BLEED LINE DURING ENGINE CONDITIONING IS SUFFICIENT (APPROXIMATELY 0.9 LBS/SEC) TO CAUSE A WATER HAMMER EFFECT (325 PSIA) UPON SUDDEN CLOSURE OF THE DISCONNECT. PROBABLE RUPTURE OF THE ORBITER BLEED SYSTEM RESULTING IN LEAKAGE OF LH2 INTO THE AFT COMPARTMENT. POSSIBLE OVERPRESSURIZATION OF THE AFT COMPARTMENT AND FIRE/EXPLOSION HAZARD. POSSIBLE LOSS OF CRITICAL FUNCTIONS DUE TO ADJACENT COMPONENT

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EXPOSURE TO CRYOGENICS. LEAKAGE DETECTABLE USING AFT COMPARTMENT  
HAZARDOUS GAS DETECTION SYSTEM (HGDS).

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

**(C) MISSION:**  
POSSIBLE LOSS OF CREW/VEHICLE.

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
SAME AS C.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**  
NONE.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**  
FOR THIS FAILURE TO OCCUR, THE GROUND HALF POPPET OR POPPET BODY SUPPORT  
WEBS MUST FAIL STRUCTURALLY DURING FLOW. THE POPPET OF THE GROUND HALF  
DISCONNECT INCLUDES A PROBE THAT MECHANICALLY PUSHES THE ORBITER HALF  
POPPET OPEN DURING THE UMBILICAL ENGAGEMENT. BOTH POPPETS ARE SPRING  
LOADED TO THE CLOSED POSITION.

THE GROUND HALF POPPET (INCLUDING THE PROBE) IS MACHINED FROM A SINGLE PIECE  
OF 6061 ALUMINUM. THE GROUND HALF HOUSING IS MACHINED FROM 6061 ALUMINUM.  
POPPET BODY SUPPORT WEBS ARE AN INTEGRAL PART OF THE GROUND HALF HOUSING.  
TO REDUCE MASS THE INSIDE OF THE POPPET (INCLUDING THE PROBE) IS MACHINED SO  
THAT THE PROBE BECOMES A 0.625 INCH O.D. CYLINDER WITH A 0.1 INCH WALL AND IS  
ABOUT 5 INCHES LONG.

STRUCTURAL ANALYSIS INDICATES POSITIVE MARGINS OF SAFETY FOR ALL CONDITIONS  
OF VALVE OPERATIONS. DURING QUAL TESTING 2000 MATE/DEMATE CYCLES WERE  
SUCCESSFULLY PERFORMED.

**(B) TEST:**  
ATP

DISCONNECT DISENGAGED

ORBITER HALF

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AMBIENT PROOF (520 PSIG)

AMBIENT HOUSING LEAKAGE (400 PSIG)

AMBIENT CLOSURE DEVICE LEAKAGE (20 & 400 PSIG)

GROUND HALF

AMBIENT PROOF (200 PSIG)

AMBIENT HOUSING LEAKAGE (100 PSIG)

AMBIENT CLOSURE DEVICE LEAKAGE (100 PSIG)

DISCONNECT ENGAGED (WITH RADIAL AND ANGULAR MISALIGNMENT AT MINIMUM AND MAXIMUM BELLOWS COMPRESSION)

PROOF PRESSURE (200 PSIG)

AMBIENT EXTERNAL LEAKAGE (25 & 100 PSIG)

CRYO (-255 DEG F) EXTERNAL LEAKAGE (100 PSIG)

ENGAGE - DISENGAGE CYCLE

CERTIFICATION

DURING ALL MATED TESTS THE ORBITER HALF IS RIGIDLY MOUNTED AND THE GROUND HALF IS MOUNTED WITH RADIAL AND ANGULAR MISALIGNMENT.

CRYO LEAKAGE (-400 DEG F)

MATED: 100 PSIG

ORBITER HALF: 25 AND 100 PSIG

GROUND HALF: 25 AND 100 PSIG

AMBIENT LEAKAGE

MATED: 25 AND 100 PSIG

ORBITER HALF: 20 AND 400 PSIG

GROUND HALF: 25 AND 100 PSIG

AMBIENT EXTERNAL BODY LEAKAGE

ORBITER HALF: 400 PSIG

GROUND HALF: 100 PSIG

LIFE CYCLES

2000 CYCLES (10 SERIES):

199 CYCLES AT AMBIENT TEMPERATURE

ONE CYCLE AT CRYO TEMPERATURE (-255 DEG F)

VIBRATION

TRANSIENT SINUSOIDAL VIBRATION

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ORBITER HALF: 5 TO 35 HZ AT ZERO PSIG AND AMBIENT TEMPERATURE

RANDOM VIBRATION IN EACH OF TWO AXES AT -280 DEG F  
MATED: 40 PSIG, 9 MINUTES  
ORBITER HALF: 80 PSIG, 52 MINUTES  
GROUND HALF: 0 PSIG, 9 MINUTES

THERMAL CYCLE TEST: 3 CYCLES (+70 TO -280 TO +70 TO +350 DEG F)

SALT FOG, BENCH HANDLING SHOCK AND DESIGN SHOCK PER MIL-STD-810, SAND AND DUST TEST

FLOW CAPACITY TEST (8 TO 18.5 LBS/SEC)

BURST TEST  
MATED: 400 PSIG  
ORBITER HALF: 600 PSIG  
GROUND HALF: 400 PSIG

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

**(C) INSPECTION:**  
RECEIVING INSPECTION

RAW MATERIALS, INCLUDING CHEMICAL AND MECHANICAL REQUIREMENTS, ARE VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION. INSPECTION VERIFIES CERTIFICATION OF ULTRASONIC INSPECTION OF BODY HOUSING FORGING.

CONTAMINATION

CLEANING PROCEDURES AND CONTAMINATION CONTROL REQUIREMENTS ARE VERIFIED BY INSPECTION. CLEANLINESS TO LEVEL 400A IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

ALL PARTS ARE PROTECTED FROM DAMAGE AND CONTAMINATION. ALL CRITICAL DIMENSIONS AND FINISHES ARE VERIFIED BY INSPECTION. SEALING SURFACE OF THE POPPET IS INSPECTED USING 10X MAGNIFICATION. DRAWING TORQUE REQUIREMENTS ARE VERIFIED. SEALS ARE VISUALLY EXAMINED, PRIOR TO INSTALLATION, FOR DAMAGE AND CLEANLINESS USING 10X MAGNIFICATION. MANDATORY INSPECTION POINTS ARE INCLUDED IN THE ASSEMBLY PROCEDURE. LOG OF CLEAN ROOM AND TOOL CALIBRATION IS REQUIRED AND VERIFIED. ALL SPRINGS ARE LOAD TESTED AND VERIFIED BY INSPECTION.

CRITICAL PROCESS

HEAT TREATMENT, PARTS PASSIVATION, AND ANODIZING ARE VERIFIED. CHEMICAL FILM PROTECTANT AND DRY FILM LUBRICANT ARE VERIFIED.

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NONDESTRUCTIVE EVALUATION

BODY HOUSING IS FLUORESCENT PENETRANT INSPECTED. WELDS ARE VISUALLY EXAMINED AND VERIFIED BY X-RAY AND DYE PENETRANT. BELLOWS ASSEMBLY IS PROOF PRESS TESTED AND LEAK CHECKED.

TESTING

ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING FOR SHIPPING IS VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY:**

CURRENT DATA ON TEST FAILURE, FLIGHT FAILURE, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

**(E) OPERATIONAL USE:**

FLIGHT:  
NO CREW ACTION CAN BE TAKEN.

GROUND:  
GROUND OPERATIONS SAFING PROCEDURES CONTAIN SAFING SEQUENCE OF EVENTS FOR MAJOR LEAKS IN THE HYDROGEN SYSTEM.

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**- APPROVALS -**

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S&R ENGINEERING	: W.P. MUSTY	: /S/ W. P. MUSTY
S&R ENGINEERING ITM	: P. A. STENGER-NGUYEN	: /S/ P. A. STENGER-NGUYEN
DESIGN ENGINEERING	: MIKE FISCHER	: /S/ MIKE FISCHER
MPS SUBSYSTEM MGR.	: TIM REITH	: /S/ TIM REITH
MOD	: BILL LANE	: /S/ BILL LANE
USA SAM	: MIKE SNYDER	: /S/ MIKE SNYDER
USA ORBITER ELEMENT	: SUZANNE LITTLE	: /S/ SUZANNE LITTLE
NASA SR&QA	: ERICH BASS	: /S/ ERICH BASS