

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- HARDWARE  
NUMBER: M0-AG1-E01 -X**

**SUBSYSTEM NAME:** REMOTELY OPERATED FLUID UMBILICAL (ROFU)  
**REVISION:** 12/08/02

**PART DATA**

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<b>PART NAME VENDOR NAME</b>	<b>PART NUMBER VENDOR NUMBER</b>
:ROFU	V847-544100-001
:QUICK DISCONNECT SYMETRICS (PARKER STRATOFLEX)	MC276-0053-1001/-2001 516001-1001/-2001

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:** MC276-0053-1001 IS SOCKET, FEMALE HALF, ON ORBITER (TYPE I) MC276-0053-2001 IS NIPPLE, MALE HALF, ON PAYLOAD (TYPE II)

**REFERENCE DESIGNATORS:** 40P848MD1, 40P848MD2, 40P847MD1, 40P847MD2

**QUANTITY OF LIKE ITEMS:** 2  
TWO MALE HALF QD'S. TWO FEMALE HALF QD'S

**FUNCTION:**  
THE DISCONNECT (QD) PROVIDES THE CONNECTION BETWEEN THE ORBITER PAYLOAD BAY MOUNTED WATER COOLING SYSTEM AND THE PAYLOAD. THE QD CONSISTS OF A PAYLOAD HALF (MALE CONNECTOR) AND AN ORBITER PAYLOAD COOLING SYSTEM HALF (FEMALE). THERE ARE TWO QD'S, ONE EACH FOR COOLANT WATER SUPPLY AND RETURN. THE TWO HALVES ARE ENGAGED BY BEING PUSHED TOGETHER AND DISENGAGED BY BEING PULLED STRAIGHT BACK. THE ENGAGED QD PERMITS FLOW IN EITHER DIRECTION. THE DISENGAGED QD PROVIDES SHUTOFF CAPABILITY. COOLANT SYSTEM PRESSURE IS 300 PSIA. MAXIMUM. THE QD IS REQUIRED TO OPERATE AT ANY SYSTEM PRESSURE FROM 0 TO 300 PSIA. MATED DISCONNECTS PERMIT FLOW RATE OF 1000 LB PER HOUR OF WATER AT 300 PSIA WITH PRESSURE DROP NOT EXCEEDING 1.0 PSI. QD TRAVEL FOR FULL ENGAGEMENT IS 0.984 INCH, MAX. BOTH QD'S ARE ENGAGED OR DISENGAGED SIMULTANEOUSLY BY THE SAME MECHANISM. LINE SIZE IS 5/8 INCH DIAMETER. FLOW RATE IS 500 LB/HR, NOMINAL. THE SYSTEM IS DESIGNED FOR USE OF WATER ONLY AS ITS COOLANT. THE SYSTEM WAS TESTED WITH A PARTIAL CONTAMINATION OF FREON 21 IN CASE THERE MAY BE SOME FREON CONTAMINATION FROM THE HEAT EXCHANGER. THESE TESTS VERIFIED THAT SYSTEM INTEGRITY WOULD BE MAINTAINED WITH THIS LEVEL OF CONTAMINATION

**FAILURE MODES EFFECTS ANALYSIS FMEA -- FAILURE MODE**

**NUMBER: M0-AG1-E01- 03**

**REVISION#: 01/23/03**

**SUBSYSTEM NAME: REMOTELY OPERATED FLUID UMBILICAL (ROFU)**

**LRU: QUICK DISCONNECT**

**CRITICALITY OF THIS**

**ITEM NAME: QUICK DISCONNECT**

**FAILURE MODE: 2/2**

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**FAILURE MODE:**

EXTERNAL LEAKAGE BEFORE OR AFTER DISCONNECT

**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:**

VIBRATION, DAMAGED SEAL, DAMAGED OR BROKEN PART IN QD, FREON 21 CONTAMINATION.

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

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**REDUNDANCY SCREEN**

- A) N/A
- B) N/A
- C) N/A

**PASS/FAIL RATIONALE:**

A)  
N/A

B)  
N/A

C)  
N/A

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

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THE ACTIVE COOLING SYSTEM CONTAINS LESS THAN 3 GALLONS OF WATER WHEN IT IS NOT CONNECTED WITH MPLM OR 9 GALLONS IF CONNECTED. DEPENDING ON SIZE, ANALYSIS INDICATES THAT, AT THE MOST, APPROXIMATELY 50 IN3 (~ 4 CUPS) OF WATER WOULD BE RELEASED. POSSIBLE LOSS OF ACTIVE COOLING FOR PAYLOAD IN ORBITER PAYLOAD BAY.

**(B) INTERFACING SUBSYSTEM(S):**

FAILURE IS INDEPENDENT OF ORBITER ECLSS SYSTEM. NO EFFECT ON EQUIPMENT IN PAYLOAD BAY. LEAKED FLUID WOULD FREEZE OR SUBLIMATE ON ORBIT.

**(C) MISSION:**

POSSIBLE LOSS OF MISSION OBJECTIVE (ISS SUPPORT).

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

NO EFFECT ON CREW OR ORBITER. ANALYSIS INDICATES THAT THE SMALL QUANTITY OF WATER [50 OR SO CUBIC INCHES (~ 4 CUPS)] THAT WOULD BE RELEASED DOES NOT POSE A HAZARD TO THE ORBITER. (REF. ANALYSIS NO. GDS-FSSO-02-012, DATED DECEMBER 12, 02).

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

N/A

**SUCCESS PATHS REMAINING AFTER FIRST FAILURE: 0**

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- TIME TO EFFECT -

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**REACTION TIME: IMMEDIATE**

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-DISPOSITION RATIONALE-

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**(A) DESIGN:**

SEALS ARE STAINLESS STEEL AND NEOPRENE. SEALS ARE RESISTANT TO FREON 21 CONTAMINATION.

**(B) TEST:**

QUALIFICATION TESTS, REF. CR NO. 60-44-544100-001, INCLUDE RANDOM VIBRATION, SHOCK, LEAKAGE, FLOW AND PRESSURE DROP, SALT FOG, SAND AND DUST, AIR INCLUSION, OPERATIONAL CYCLES AND BURST PRESSURE. A QUICK DISCONNECT EVALUATION TEST WITH FREON 21 SOLUTIONS (AT 1460 PPM FREON 21) VERIFIED THE INTEGRITY OF THE O-RING SEAL.

ACCEPTANCE TESTS INCLUDE PROOF PRESSURE, OPERATIONAL CYCLES, STROKE, OVERSTROKE, ALIGNMENT, FLUID FLOW/PRESSURE DROP. SYSTEM CHECKOUT ON THE VEHICLE CAN BE PERFORMED, BUT LIMITED WHEN MPLM OR OTHER PAYLOAD WITH SIMILAR SIZE INSTALLED, USING GSE MODEL NOS. C73-0012 (ORBITER DISCONNECT SIMULATOR) AND S73-0003 (PAYLOAD DISCONNECT SIMULATOR).  
GROUND TURNAROUND TEST

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ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD. SYSTEM CHECKOUT IS LIMITED WHEN MINI PRESSURIZED LOGISTICS MODULE (MPLM) IS INSTALLED

**(C) INSPECTION:**

RECEIVING INSPECTION  
MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION. ALL PURCHASED PARTS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL  
INSPECTION VERIFIES CLEANLINESS IS MAINTAINED AND BURRS REMOVED. VISUAL INSPECTION IS PERFORMED PRIOR TO DELIVERY.

ASSEMBLY/INSTALLATION  
DIMENSIONS OF DETAIL PARTS, SURFACE FINISHES, IDENTIFICATION, ASSEMBLY SEQUENCE, INSTALLATION ON SWING ARM AND PAYLOAD ASSEMBLIES ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES  
HEAT TREATMENTS ARE VERIFIED BY INSPECTION.

TESTING  
ACCEPTANCE TESTS OF THE QUICK DISCONNECT PER APPLICABLE PROCEDURES ARE VERIFIED BY INSPECTION PRIOR TO DELIVERY. INSPECTION ALSO VERIFIES ACCEPTANCE TESTS OF SWING ARM AND PAYLOAD DISCONNECT ASSEMBLIES WITH QUICK DISCONNECTS INSTALLED.

HANDLING / PACKAGING  
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION

**(D) FAILURE**

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:**

NONE

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**- APPROVALS -**

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S&R ENGINEER	:D. MAYNE	:/S/ D. M.MAYNE_____
CARGO/INTEG ITM.	:J. CAPALENI	:/S/ BOB DUEEASE FOR_____
DESIGN ENGINEER	:L. T. HARPER	:/S/ L. T. HARPER_____
SSM	:L. J. SALVADOR	:/S/ PHAM HOE FOR_____
NASA/DCE	:B. BROWN	:/S/ B. BROWN_____
MOD	:C. STEPHENSON	:/S/ C.STEPHENSON_____

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SR&QA  
USA/SAM

:H. MALTBY  
:R. SMITH

:/S/ HARRY MALTBY \_\_\_\_\_  
:/S/ R.SMITH \_\_\_\_\_

USA CARGO/INTG ELEMENT  
USA ORBITER ELEMENT

:S. KUNKEL  
S. LITTLE

:/S/ S. KUNKEL \_\_\_\_\_  
:/S/ SUZANNE LITTLE \_\_\_\_\_