

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- HARDWARE****NUMBER: M0-AG1-E01 -X****SUBSYSTEM NAME:** REMOTELY OPERATED FLUID UMBILICAL (ROFU)**REVISION:**

12/08/02

**PART DATA**

<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

**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- 01**

**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:**

FAILS TO ENGAGE OR RESTRICTED FLOW

**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:**

EXCESSIVE MISALIGNMENT, INSUFFICIENT ENGAGEMENT FORCE AVAILABLE, JAMMED OR BROKEN INTERNAL PART, PARTICULATE OR FREON 21 CONTAMINATION, WEAR, DISLODGED O-RING, INSUFFICIENT HOOK REACH, ENTRAPPED FLUID, FROZEN LINE, INDICATOR SWITCH MODULE JAMMED.

**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:**

LOSS OF ACTIVE COOLING CAPABILITY FOR PAYLOAD IN ORBITER CARGO BAY.

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

LOSS OF PAYLOAD CAPABILITY/FUNCTION (MINI PRESSURIZED LOGISTICS MODULE OR OTHER PAYLOAD)

**(C) MISSION:**

POSSIBLE LOSS OF MISSION OBJECTIVE (ISS SUPPORT). PROBABLE NEED FOR CONTINGENCY EVA.

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

NO EFFECT ON ORBITER CREW OR VEHICLE.

**(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:**

THE PAYLOAD MALE HALF DISCONNECT AND ORBITER FEMALE HALF DISCONNECT ARE ENGAGED BY A LATCHING MECHANISM CAPABLE OF APPLYING 400 LB FORCE. RESISTING FORCE OF BOTH QD ASSY'S TOGETHER IS 230 TO 341 LB. THE TWO DISCONNECT HALVES WILL ACCOMMODATE 1 DEGREE OF ANGULAR MISALIGNMENT AND 0.039 IN. AXIAL MISALIGNMENT. MATERIALS AND SURFACE FINISHES MINIMIZE FRICTION AND WEAR. LATCH TRAVEL PROVIDES ADEQUATE MARGIN FOR COMPLETING QD ENGAGEMENT STROKE OF .984 IN. PROTECTION OF DISCONNECTS DURING TURNAROUND IS PROVIDED BY GSE MODEL NO. A73-0004 CAP AND COVER SET.

**(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.

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C73-0012 (ORBITER DISCONNECT SIMULATOR) AND S73-0003 (PAYLOAD DISCONNECT SIMULATOR).  
GROUND TURNAROUND TEST  
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 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:**

POSSIBLE ATTEMPT BY EVA CREWMAN TO MANUALLY ASSIST ENGAGEMENT OF BOTH QD ASSY'S IN PAYLOAD BAY.

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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	:H. MALTBY	:/S/ HARRY MALTBY_____
USA/SAM	:R. SMITH	:/S/ R. SMITH_____
USA CARGO/INTG ELEMENT	:S. KUNKEL	:/S/ S. KUNKEL_____
USA ORBITER ELEMENT	:S. LITTLE	:/S/ SUZANNE LITTLE_____