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PRINT DATE: 01/24/91

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: 06-1C-0229-X

SUBSYSTEM NAME: ARS - ARPCS

REVISION : 4 10/16/90

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU 01	QUICK DISCONNECT/CAP	MC276-0020-1023
LRU 02	QUICK DISCONNECT SYMETRICS	502040-1023
LRU 03	QUICK DISCONNECT CAP SYMETRICS	502040-15

PART DATA

QUANTITY OF LIKE ITEMS: 1

FUNCTION:

PROVIDES NITROGEN SYSTEM/GSE INTERFACE FOR PRESSURIZATION OF THE WATER TANKS DURING GROUND OPERATIONS. PRESSURE SEALING CAP IS INSTALLED AFTER GSE DISCONNECT.

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SUBSYSTEM: ARS - ARPCS
LRUQUICK DISCONNECT/CAP
ITEM NAME: QUICK DISCONNECT CAP

CRITICALITY OF THIS
FAILURE MODE:1R3

FAILURE MODE:
INTERNAL LEAKAGE

MISSION PHASE:

LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT

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

CAUSE:

MECHANICAL SHOCK, VIBRATION, CONTAMINATION, CORROSION, SEAL MATERIAL
DEGRADATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) FAIL
B) FAIL
C) PASS

PASS/FAIL RATIONALE:

A)
SCREEN A FAILS BECAUSE CAP SEAL CANNOT BE VERIFIED UNLESS QD LEAKS
INTERNALLY.

B)
SCREEN B FAILS BECAUSE INTERNAL LEAKAGE OF THE QD IS NOT DETECTABLE
UNTIL SECOND ASSOCIATED FAILURE (CAP LEAKAGE) OCCURS.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NO EFFECT - REDUNDANT SEAL CONTAINS LEAKAGE.

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

(C) MISSION:
SAME AS A.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
AFTER SECOND ASSOCIATED FAILURE (REDUNDANT SEAL LEAKAGE):
GN2 PRESSURIZATION FOR WATER EXPULSION IS LOST WHEN C/A IS IMPLEMENTED.
CABIN ATMOSPHERE REMAINS TO PRESSURIZE TANKS, THROUGH EITHER OF TWO
PATHS (H2O ALTERNATE PRESSURE VALVE OR TANK A PRESSURE CONTROL VALVES).
WHEN CABIN PRESSURE IS USED TO PRESSURIZE WATER TANKS, TOPPING FES
OPERATION IS RESTRICTED. POSSIBLE LOSS OF CREW/VEHICLE UPON SUBSEQUENT
FAILURE IN THE ACTIVE THERMAL CONTROL SYSTEM.

- DISPOSITION RATIONALE -

(A) DESIGN:
THE MALE COUPLING IS A MECHANICAL CONNECTOR WHICH PERMITS SEPARATION
WITHOUT FLUID LOSS. THE MALE COUPLING ALSO HAS AN INTEGRAL POPPET
VALVE WHICH STOPS FLOW WHEN THE HALVES ARE SEPARATED. THE BODY OF THE
QUICK DISCONNECT, POPPET, AND SPRING ARE MADE OF 17-7 PH CONDITION A
CRES. 17-7 PH IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL
WHICH HAS A HIGH STRENGTH TO WEIGHT RATIO. THE SEALS ARE MADE OF
ETHYLENE PROPYLENE RUBBER (EPR) WHICH IS CHARACTERIZED BY TOUGHNESS,
EXCELLENT CHEMICAL RESISTANCE, LOW COEFFICIENT OF FRICTION, AND NEAR
ZERO MOISTURE ABSORPTION. THE QD CAP IS OF 17-7 PH OR 15-5 PH
(INTERCHANGEABLE) AND ITS O-RING IS EPR.

(B) TEST:
ACCEPTANCE TEST - PER ATP SYM75-202. PROOF, INTERNAL AND EXTERNAL LEAK
TEST PRESSURE 90 +10/-0 PSIG. LEAK RATE 1×10^{-4} SCCS MAX.

QUALIFICATION TEST - PER SYM75-002. LIFE CYCLE TEST - 1000 CONNECT/
DISCONNECT CYCLES. BURST PRESSURE - 110 PSIG MINIMUM FOR 2 MINUTES.
RANDOM VIBRATION SPECTRUM - 20 TO 70 HZ INCREASING AT 6 DB/OCTAVE TO
0.1 G**2/HZ AT 70 HZ. CONSTANT AT 0.1 G**2/HZ FROM 70 TO 100 HZ. 100
TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.2 G**2/HZ AT 150 HZ. CONSTANT
AT 0.2 G**2/HZ FROM 150 TO 300 HZ. 300 TO 400 HZ DECREASING AT 6
DB/OCTAVE TO 0.12 G**2/HZ AT 400 HZ. CONSTANT AT 0.12 G**2/HZ FROM 400
TO 1000 HZ. DECREASING AT 9 DB/OCTAVE FROM 1000 TO 2000 HZ. DESIGN
SHOCK - CERTIFIED BY SIMILARITY TO COUPLINGS QUAL TESTED FOR LOCKHEED

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(REF SYMETRICS REPORT 5000-1) TO IDENTICAL REQUIREMENTS EXCEPT IN TWO AXES INSTEAD OF THREE. DUE TO THE SYMMETRICAL CONFIGURATION OF THE COUPLINGS THIS DIFFERENCE IS NOT SIGNIFICANT. THE LOCKHEED COUPLING TEST DATA ARE CONSIDERED TO BE DIRECTLY APPLICABLE TO THE MC276-0020 COUPLINGS, AND TO PROVIDE FULL CONFIRMATION OF COMPLIANCE WITH THE DESIGN SHOCK REQUIREMENT.

IN-VEHICLE TESTING - DEMATED LEAK TEST IS PERFORMED WITH GHE AT 15.5 - 17 PSIG, 1.4 X 10 EXP -4 SCCS MAX LEAKAGE OR WITH GN2, NO BUBBLES IN ONE MINUTE.

OMRSD - WATER TANK PRESSURIZATION SYSTEM IS LEAK TESTED BEFORE THE FIRST REFLIGHT OF EACH ORBITER AND AT INTERVALS OF TEN FLIGHTS, AT 15.5 - 17 PSIG, 40 SCCM MAX LEAKAGE. THE CAPPED QD IS BUBBLE LEAK TESTED AT THE SAME PRESSURE.

(C) INSPECTION:

RECEIVING INSPECTION

RAW MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CONTAMINATION AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING PROCESS, INSTALLATION AND ASSEMBLY ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. 10X VISUAL INSPECTION ON SEAL RING VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

LEAK TEST IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREATING IS VERIFIED BY INSPECTION. APPLICATION OF LUBRICANT ON SEAL RING VERIFIED BY INSPECTION.

TESTING

ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

NO FAILURE HISTORY APPLICABLE TO INTERNAL LEAKAGE FAILURE MODE. THE QUICK DISCONNECT HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM FOR THIS FAILURE MODE.

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(E) OPERATIONAL USE:

1. CREW ACTION
NONE; FIRST FAILURE IS NOT DETECTABLE.
2. TRAINING
NONE.
3. OPERATIONAL CONSIDERATION
 - A. FAILURE IS NOT DETECTABLE IN FLIGHT UNLESS THERE IS A SECONDARY FAILURE.
 - B. REAL TIME DATA SYSTEM ALLOWS FOR GROUND MONITOR OF SUPPLY H2O PRESSURES.
 - C. SECOND FAILURE ALLOWS ONLY CABIN ATMOSPHERE TO PRESSURIZE H2O TANKS. SUSTAINED FES OPERATIONS MAY NOT BE STABLE.

- APPROVALS -

RELIABILITY ENGINEERING:	D. R. RISING	DRK	:	<u>DRK</u>
DESIGN ENGINEERING	: K. KELLY	KK	:	<u>KK</u>
QUALITY ENGINEERING	: M. SAVALA		:	<u>M. Savala for OSB 2/8/91</u>
NASA RELIABILITY	:	JRB	:	<u>JRB 4-2-91</u>
NASA SUBSYSTEM MANAGER	:		:	<u>D.M. Kelly 4/3/91</u>
NASA QUALITY ASSURANCE	:		:	<u>DM</u>