

CRITICAL ITEMS LIST (CIL)

SYSTEM:	Propulsion/Mechanical	FUNCTIONAL CRIT:	1
SUBSYSTEM:	Ground Umbilical Carrier Assembly	PHASE(S):	a
REV & DATE:	J, 12-19-97	HAZARD REF:	S.06
DCN & DATE:			
ANALYSTS:	J. Attar/H. Claybrook		

FAILURE MODE: Leakage

FAILURE EFFECT: a) Loss of mission and vehicle/crew due to leakage of GH2, resulting in fire/explosion.

TIME TO EFFECT: Seconds

FAILURE CAUSE(S):
 A: Structural Failure of Disconnect Component
 B: Seal Leakage
 C: Mating Surface Defects
 D: Seizure of Spring Spacer

REDUNDANCY SCREENS: Not Applicable

FUNCTIONAL DESCRIPTION: Interface hardware used to transport GHe/GN2 from facility disconnects for vent valve control, compartment purge, propellant conditioning system and provide separation at lift-off.

<u>FMEA ITEM CODE(S)</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY</u>	<u>EFFECTIVITY</u>
2.14.3.1	PD4800174-049	Pressurization Disconnect	3	LWT-54 & Up
2.14.4.1	PD4800174-059	Pressurization Disconnect	2	LWT-54 & Up

REMARKS: These items are grouped as the failure mode, causes and effects are the same.

CRITICAL ITEMS LIST (CIL)
CONTINUATION SHEET

SYSTEM: Propulsion/Mechanical
SUBSYSTEM: Ground Umbilical Carrier Assembly
FMEA ITEM CODE(S): 2.14.3.1, 2.14.4.1

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RATIONALE FOR RETENTION

DESIGN:

The pressurization disconnects are installed on the ground umbilical carrier assembly and provides gaseous helium and hot nitrogen to the ET carrier assembly. The disconnects incorporate a receptacle to facilitate fluid transfer to the helium inject, nose cone and intertank purge, and GO2/GH2 vent valve actuation interfaces. At T-0, the disconnect is separated from the ETCA.

- A: The disconnect components fabricated from 2024-T851 aluminum alloy and 300 series CRES and is designed to the required proof factor (1.25) and ultimate (4.0) factor of safety (ET Stress Report 826-2188 and Purolator Stress Report TD-956). Materials selected in accordance with MMC-ET-SE16 and controlled per MMA approved vendor product assurance plan assures conformance of composition, material compatibility and properties.
- B, C: The disconnect assembly utilizes lip type seals fabricated of Kel-F material. Sealing is achieved by expanding the lip type seal with a packing gland against the polished surface of the mating fitting. A spring in the disconnect holds the seal against the mating surface. Mating surfaces are machined, anodized and polished after anodizing per engineering drawings to assure a proper sealing surface.
- D: Mating surface dimensional tolerances and finish are specified that provide adequate clearance.

TEST:

The Pressurization Disconnects are qualified. Reference CDQ MMC-ET-TM06-005.

Development: Testing of a disconnect assembly (ground and flight sides) included proof pressure, bonding, operational tests (at ambient and cryogenic), leakage (at ambient and cryogenic), vibration, leakage, 100 operational life cycles (at ambient and cryogenic) and burst pressure (Purolator Products TR-1107).

Qualification: Testing of two disconnect assemblies included proof pressure, operational test, and leakage for acceptance; proof pressure, operational test, leakage, bonding, operational life test (110 cycles; 200°F, ambient, -55°F, and -300°F), liftoff random vibration, and burst pressure (MMC-ET-RA09-16).

Testing of two disconnect assemblies (the ground sections are identical except that one lip type seal and one gland packing were replaced with a seal support) included proof pressure, operational test, and leakage for acceptance; ten operational life cycles, leakage, operational test, proof pressure, and burst pressure. The above testing was performed to qualify the disconnect assembly to a higher temperature and operating pressure.

System Qualification: The ET umbilical and intertank access arm system qualification testing was conducted at the Launch Equipment Test Facility (LETF) at KSC. The objectives were to verify the KSC ground system hardware design and to perform integrated testing with the ETCA. Testing was conducted in a series of 13 tracking tests and 17 disconnect tests simulating various vehicle configurations with motions for anticipated environmental, test, and launch conditions from predicted worst-case vehicle stacking and on-pad positioning offsets including 2.75 seconds of simulated engine firing.

Test results and data analysis verified that the KSC design/hardware is satisfactory, and when integrated with the MSFC flight umbilical, the system meets all of the specified requirements and is qualified for Space Shuttle operations at launch sites (KSC-DD-119-TR).

Acceptance:

Vendor - (Disconnect Assembly):

- A-D: Perform proof pressure, operational test (mate/demate fit check), and leakage test (Purolator ATPs 7543704 for PD4800174-049 and 7543705 for PD4800174-059).

Launch Site:

- B-D: Perform leakage tests (OMRSD File IV).

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INSPECTION:

Vendor Inspection - Lockheed Martin Surveillance:

- A, B: Verify materials selection and verification controls (MMC-ET-SE16 and Purolator drawings 7543109, 7543123, 7543113, 7543110 and 7543108).
- B: Inspect (visually) seal surfaces for freedom of nicks, scratches or other imperfections during installation (drawing 7543110 Purolator).
- C: Inspect surface finish and dimensions (Purolator drawings 7543111 and 7543108).
- C, D: Witness assembly (Purolator drawings 7543704 for PD4800174-049 and 7543705 for PD4800174-059).

Lockheed Martin Procurement Quality Representative:

- A, B: Witness proof pressure, operational and leakage tests (Purolator ATPs 7543704 for PD4800174-049 and 7543705 for PD4800174-059).

Launch Site:

- A-C: Verify installation and witness torque (drawing 82629021109).
- A-D: Witness leakage test (OMRSD File IV).
- A-D: Inspect for freedom of damage during refurbish (OMI T6148).
- A-D: Witness leakage test (OMI T6151, T6152).

FAILURE HISTORY:

Current data on test failures, unexplained anomalies and other failures experienced during ground processing activity can be found in the PRACA data base.