CRITICAL ITEMS LIST (CIL)

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|---|---|---|---|
| SYSTEM: | Propulsion/Mechanical | FUNCTIONAL CRIT: | 1 |
| SUBSYSTEM: | External Tank Carrier Assembly | PHASE(S): | a |
| REV & DATE: | J, 12-19-97 | HAZARD REF: | S.05 |
| 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 (Flight Side)
B: Structural Failure of Umbilical Carrier Detail

REDUNDANCY SCREENS: Not Applicable

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

| FMEA ITEM CODE(S) | PART NO. | PART NAME | QTY | EFFECTIVITY |
|---|---|---|---|---|
| 2.15.2.1 | P04800174-030 | Press Disconnect (Flight Side) | 5 | LWT-54 & Up |

REMARKS:

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|---|---|---|---|
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| SUBSYSTEM: | External Tank Carrier Assembly | DCN & DATE: | |
| FMEA ITEM CODE(S): | 2.15.2.1 | | |

RATIONALE FOR RETENTION

DESIGN:

A: The pressurization disconnect (flight side) is installed on the ET umbilical carrier assembly and provides the interface between the ETCA and ground facility. The disconnect telescopes into the ground umbilical carrier disconnect to provide connections for helium injection, nose cone and intertank purge, and GO2/GH2 vent valve actuation. At T-0, the disconnects are separated leaving each respective system inactive during flight. The disconnect is fabricated from 6061-T6 aluminum alloy, penetrant inspected, and is designed to the required proof factor (1.20) and ultimate (1.50) 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 MMMA Approved Vendor Product Assurance Plan assures conformance of composition, material compatibility and properties.

B: The Umbilical Carrier Plate detail is a structural plate installed on the External Tank Carrier Assembly (ETCA) that provides attachment of the pressurization and electrical disconnects. The detail is machined from 6061 T6 aluminum alloy plate and penetrant inspected. The detail plate was designed to the required yield (1.1) and ultimate (1.4) safety factors (ET Stress Report 826-2188). Materials selected in accordance with MMC-ET-SE16 and controlled per MMMA Approved Product Assurance Plan assures conformance of composition, material compatibility and properties.

TEST:

The Pressurization Disconnects (flight side) are qualified as a subassembly of each disconnect assembly. Reference COQ MMC-ET-TM06-005.

The Umbilical Support Detail is a component of the ETCA which is qualified. Reference COQ MMC-ET-TM06-100.

A: Development: Testing of a disconnect assembly (ground and flight sides) included proof pressure, bonding, operational (at ambient and cryogenic), leakage (at ambient and cryogenic), vibration, post vibration leakage, 100 operational life cycles (at ambient and cryogenic), and burst pressure. There was no evidence of structural failure (Purolator Products TR-1187).

A: Qualification: Testing of two disconnect assemblies included proof pressure, operational, and leakage for acceptance, proof pressure, operational, leakage, bonding, 110 operational life cycles, high temperature, ambient, environmental, and cryogenic, lift-off random vibration, and burst pressure. There was no evidence of structural failure (MMC-ET-RA09-16).

A: Qualification: 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 tests, proof pressure and burst pressure. The above testing was repeated to qualify the disconnect assembly to a higher temperature and operating pressure (MMC-ET-RA09-6).

A, B: System Qualification: Testing of one Ground Umbilical Carrier Assembly (GUCA) and External Tank Carrier Assembly (ETCA) included 15 life cycle separations at cryogenic temperature using pyro separator bolts. In addition, the carrier assemblies were separated two times at cryogenic temperatures using lanyard separation. Leakage measurements made with helium at ambient and cryogenic temperatures were within specified criteria of 60 SCIM (MMC-ET-RA09-48). 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).

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RATIONALE FOR RETENTION

TEST: (cont)

Acceptance:

Vendor:

A: Perform proof pressure, operational tests (mate/demate fit check), and leakage test on each production assembly. (Purolator 7543429/7543293).

MAF:

A: Perform leakage test (MMC-ET-TM04k).

Launch Site:

A, B: Perform leakage test (OMRSD File IV).

INSPECTION:

Vendor Inspection - Lockheed Martin Surveillance:

A, B: Verify materials selection and verification controls (MMC-ET-SE16 and drawings 80923021027 and 7543293 Purolator).

B: Penetrant inspect after machining (drawing 80923021027).

Lockheed Martin Procurement Quality Representative:

A: Witness proof pressure, functional and leakage tests (ATP7543293, Purolator).

MAF Quality Inspection:

A: Verify installation and witness torque (drawing 80923021026).

A: Witness leakage test (MMC-ET-TM04k).

Launch Site:

A, B: Verify installation of GUCA (drawing 82629021109).

A, B: Witness leakage test (OMRSD File IV).

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.