

CRITICAL ITEMS LIST (CIL)

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|-------------|-----------------------|------------------|---------------------|
| SYSTEM: | Propulsion/Mechanical | FUNCTIONAL CRIT: | 1 |
| SUBSYSTEM: | L02 Propellant Feed | PHASE(S): | a, b |
| REV & DATE: | J, 12-19-97 | HAZARD REF: | P.09, S.07, S.11 |
| DCN & DATE: | | | |
| ANALYSTS: | J. Attar/H. Claybrook | | |

FAILURE MODE: Leakage

FAILURE EFFECT: a) Loss of mission and vehicle/crew due to fire/explosion.
b) Loss of mission and vehicle/crew due to fire/explosion.

TIME TO EFFECT: Seconds

FAILURE CAUSE(S): A: Scratched/Nicked/Misaligned
B: Deterioration
C: Flange Mating Surface Defects
D: Fracture of One Flange Bolt

REDUNDANCY SCREENS: Not Applicable

FUNCTIONAL DESCRIPTION: The Raco seals prevent leakage between flange joints of the L02 feedline.

| <u>FMEA ITEM CODE(S)</u> | <u>PART NO.</u> | <u>PART NAME</u> | <u>QTY</u> | <u>EFFECTIVITY</u> |
|--------------------------|-----------------|------------------|------------|--------------------|
| 2.1.14.1 | 55L2-5 | Raco Seal | 8 | LWT-54 & Up |

REMARKS:

CRITICAL ITEMS LIST (CIL)
CONTINUATION SHEET

SYSTEM: Propulsion/Mechanical
SUBSYSTEM: LO2 Propellant Feed
FMEA ITEM CODE(S): 2.1.14.1

REV & DATE: J, 12-19-97
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RATIONALE FOR RETENTION

DESIGN:

The Raco seal is installed between all propellant feed system line assembly flanges except at the LO2 disconnect (GFP) interface. The seal is fabricated by Furon and is similar to seals that were qualified and used on Atlas, Centaur, and Saturn IC, II and IVB vehicles. The design consists of a U shaped circular spring with a teflon jacket. The spring force assisted by media pressure is adequate to provide a seal between the teflon jacket and adjacent mating surfaces.

- A: Improper handling and installation leads only to leakage and is detected by test. If the flange joint is disassembled, seal replacement is specified and controlled by STP2012.
- B: Procurement of seals is governed by material, fabrications, processing, test and inspection specifications per MMC Standard 55L2. Teflon compatibility testing is specified for oxygen service (NHB 8060.1).
- C: Mating surface flatness, waviness, and finish are specified on engineering drawings to assure performance within the capability of the seal.
- D: Attachment fasteners were selected from the Approved Standard Parts List (ASPL 826-3500), installed per STP2014 and torqued using values specified on Engineering drawings. Procurement of fasteners is by material, fabrication, processing, test and inspection specification per MMC Standard drawing 26L2.

TEST:

The Raco Seal is certified. Reference HCS MMC-ET-TM08-L-P007.

Qualification: Thirty Raco seals, six samples of five different sizes ranging from 4 inch to 17 inch diameter, were leakage tested after being subjected to pressure temperature cycling, vibration, proof pressure and burst pressure. Testing included two samples that were subjected to 62 psig at LH2 temperature without degradation of performance.

The tests showed that the seals are capable of preventing major leakage under ET operating conditions. Leakage measured during exposure was significantly less than allowable (MMC-ET-RA09-4).

MPTA Firing/Tanking: Seals have been installed on MPTA throughout the test program that included 62.5 minutes of firing time, 27 cryogenic cycles and 42 pressurization cycles. There was no evidence of leakage due to operation or environment. Three of these seal installations were undisturbed throughout the program.

Acceptance:

Vendor:

- A, C: Perform dimensional fit and leakage tests (ATP004, Furon).
- D: Attachment bolts are procured and tested to Standard drawing 26L2.

MAF:

- A-C: Perform seal leakage tests after installation (MMC-ET-TM04k).

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RATIONALE FOR RETENTION

INSPECTION:

Vendor Inspection - Lockheed Martin Surveillance:

- B, D: Verify materials selection and verification controls (MMC-ET-SE16 and Standard drawings 55L2 and 26L2).
- C: Inspect mating surface flatness, finish, and dimensions (drawing 80912630001).

Lockheed Martin Procurement Quality Representative:

- B: Verify oxygen compatibility test requirements (Standard drawing 55L2).
- A, C: Witness dimensional fit and leakage tests (ATP004, Furon).

MAF Quality Inspection:

- A: Inspect sealing surfaces for freedom of nicks, radial scratches or other imperfections during installation (drawings 80921011009 and 80921111900).
- C: Inspect sealing surfaces for freedom of nicks, radial scratches or other imperfections (acceptance drawing 82620000001).
- A, D: Verify installation and witness torque (drawings 80921011009 and 80921111900).
- A-C: Verify leak test ports clear prior to assembly (STP2012).
- A-C: Witness seal leakage test (MMC-ET-TM04k).

Launch Site:

- A-D: Visually monitor LO2 feedline system for no leakage (OMRSD File II).

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.