

CRITICAL ITEMS LIST (CIL)

SYSTEM: Propulsion/Mechanical FUNCTIONAL CRIT: 1R  
 SUBSYSTEM: Helium Inject PHASE(S): b  
 REV & DATE: J, 12-19-97 HAZARD REF: P.02, P.06  
 DCN & DATE:  
 ANALYSTS: E. Flauss/H. Claybrook

FAILURE MODE: Fails Open  
 FAILURE EFFECT: b) Loss of mission and vehicle/crew due to fire/explosion.  
 TIME TO EFFECT: Seconds  
 FAILURE CAUSE(S): A: Poppet Fails to Seat  
 B: Leakage of O-Ring  
 REDUNDANCY SCREENS: Screen A: FAIL - No checkout capability for failure of a single check valve.  
 Screen B: FAIL - No detection method for failure mode in flight.  
 Screen C: PASS  
 FUNCTIONAL DESCRIPTION: Allows flow of helium from facility to LO2 feedline during loading; prevents backflow of LO2/GO2 when helium inject system is inactive.

<u>FMEA ITEM CODE(S)</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY</u>	<u>EFFECTIVITY</u>
2.4.19.3	47L1-1	Check Valve (Upstream and Downstream)	4	LWT-54 & Up

REMARKS:

CRITICAL ITEMS LIST (CIL)  
CONTINUATION SHEET

SYSTEM: Propulsion/Mechanical  
SUBSYSTEM: Helium Inject  
FMEA ITEM CODE(S): 2.4.19.3

REV & DATE: J, 12-19-97  
DCN & DATE:

---

RATIONALE FOR RETENTION

---

DESIGN:

Two check valves and one filter are connected in series as one assembly and two of these assemblies are connected in parallel. The parallel paths provide redundancy and protection against a check valve failing to open during helium inject operation. The series connected check valves provide redundancy for failing to close after ground umbilical separation. The valve incorporates a spring loaded poppet and nonmetallic seal. Material selected in accordance with MMC-ET-SE16 and controlled per MMA Approved Vendor Product Assurance Plan assures conformance of composition and properties.

- A: The poppet is fabricated from 304L CRES and is a flow passage closure component of the check valve which has been designed to meet the required yield (1.5) and ultimate (2.0) safety factors (ET Stress Report 826-2188). Adequate dimensional tolerances are specified for the poppet and mating surfaces that will prevent seizing, and 100% inspection is specified. Cleaning is specified for oxygen service.
- B: The teflon O-Ring is a relatively soft material that provides adequate sealing capability within the requirements specified for valve operation. The teflon conforms to any irregularities in the mating surfaces and the downstream fluid media pressure assists the sealing process. Compatibility testing for oxygen service is specified per NHB 8060.1. 100% inspection of valve components assure no damage to seals and mating surfaces.

Redundancy Description:

The series connected check valves provide redundancy to prevent the backflow of G02/L02 into the helium inject system after ground umbilical separation.

Effect of First Redundancy Loss:

A single check valve failing open in one or both flow paths will have no effect on system operation. G02/L02 backflow will be prevented by the second series connected check valve.

Effect of Second Redundancy Loss:

Both series connected check valves failing open in either flow path will allow overboard backflow of G02/L02 at the ground disconnect resulting in fire/explosion.

CRITICAL ITEMS LIST (CIL)  
CONTINUATION SHEET

SYSTEM: Propulsion/Mechanical  
SUBSYSTEM: Helium inject  
FMEA ITEM CODE(S): 2.4.19.3

REV & DATE: J, 12-19-97  
DCN & DATE:

---

RATIONALE FOR RETENTION

---

TEST:

The check valve is qualified as a subassembly of the helium inject filter/check valve assembly. Reference COQ MMC-ET-TM06-099.

Qualification: Qualification testing was performed partially at the check valve assembly level and filter check valve assembly level. The latter assembly includes a filter connected in series with two downstream check valves and appropriate sealing elements.

Valve Assembly: Testing of two valves included proof pressure at 4500 psig, external leakage, internal leakage at ambient and -300°F and cracking/reseat cycles at -300°F and +400°F.

Filter/Valve Assembly: Further testing for acceptance with the check valves installed in the filter/check valve assembly configuration included proof pressure at 4500 psig, external leakage at 3000 psig, and internal leakage at 50 psig. Other testing included sine and random vibration, post vibration external leakage at 3000 psig, internal leakage at ambient and -300°F and cracking/reseat pressure cycles at -300°F, ambient, and +400°F. There was no evidence of internal leakage during vibration test with the unit pressurized to 160 psig (MMC-ET-RA09-20).

MPTA Firings/Tankings: Two helium inject filter/check valve assemblies have been installed on MPTA. One assembly (two check valves) has accumulated 62.5 minutes of firing time and 27 cryogenic cycles. The second assembly has accumulated 22.5 minutes of firing time and 9 cryogenic cycles. There was no evidence of internal leakage due to operation or environment.

Acceptance:

Vendor - (Check Valve):

A, B: Perform proof pressure, internal leakage, and cracking/reseat pressure cycle tests (TM545 Circle Seal).

Vendor - (Filter/Check Valve Assembly):

A: Perform proof pressure and internal leakage tests (TM545 Circle Seal).

MAF - (Vehicle Assembly):

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

INSPECTION:

Vendor Inspection - Lockheed Martin Surveillance:

A, B: Verify materials selection and verification controls (MMC-ET-SE16 and standard drawing 47L1).

A, B: Verify assembly (CSC/CCD-700, Circle Seal).

A: Verify cleaning (CSC/CCD 700, Circle Seal).

Lockheed Martin Procurement Quality Representative:

A, B: Witness proof pressure, internal leakage, cracking and reseat tests (TM545, Circle Seal).

MAF Quality Inspection:

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

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.