

DATE: October 16, 1990

FMEA #: 45-570-0505-08-CV*-01

END ITEM EFFECTIVITY:

X	X	X
OV102	OV103	OV104

MODEL NO/NAME: 570-0505, Mid-Body Umbilical Carrier Plate

ORBITER SUBSYSTEM: Ground Support Equipment

PART NUMBER:	PART NAME:	REFERENCE DESIGNATION:	QUANTITY (PER SYSTEM)
249T-4TB	Check Valve	CV1	1
249T-6TB	Check Valve	CV2	1
CRITICALITY NUMBER: 18			

FUNCTION: Maintain unidirectional flow of helium and nitrogen to carrier plate purge areas.

CRITICAL FAILURE MODE: Stuck closed, loss of He and/or GN₂ purge systems.

CAUSE: Mechanical shock

FAILURE EFFECT ON:

- (A) END ITEM: Possible damage to carrier plate components from fire/explosion or icing due to leaking LH₂ or LO₂.
- (B) INTERFACING SUBSYSTEM(S): Possible damage to ground fuel/oxidizer system (hoses, valves) from fire/explosion or icing due to leaking LH₂ or LO₂.
- (C) ORBITER: Loss of orbiter from fire/explosion of hydrogen, or damage to TPS from icing. Fire hazard creates danger of possible damage to orbiter PRSD system, including flight halves of QD's.
- (D) PERSONNEL: None.

HAZARDS: Cut-off of purge could lead to accumulation and possible ignition of hydrogen gas from fuel loading system, or to icing and orbiter TPS damage; cutoff of nitrogen could lead to accumulation of oxygen resulting in fire hazard. Cutoff of either purge could result in icing.

45-870-0505-08-CV*-01 (Continued)

DATE: October 16, 1990

ACCEPTANCE RATIONALE

DESIGN: The relaxed state of the check valve is closed due to a spring force. It is designed such that increased backflow pressure increases sealing efficiency because of a metal-to-metal seat contact. The body is made of 303 CREs, the spring is 302 CREs, and the O-Rings are of Buna N. It may be mounted in any position, is designed for most gases and is quiet when switching open or closed. The design features a positive stop in both fully open and fully closed positions. This ensures no failure in the open and closed positions and eliminates spring and seal fatigue. The Buna N O-Ring is situated to absorb any mechanical shock waves during operation. It is designed to operate in the -40°F to +250°F temperature range (temperature during operation -20°F to 100°F) and 0-3000 psig rated operating pressure (limit operating pressure is 900 psi). Proof is 1 1/2 times rated operating pressure and burst is 2 1/2 times rated operating pressure.

TESTS:

ACCEPTANCE TESTS: Tests per Circle Seal Control part specification include: proof pressure, burst pressure, leakage, spring strength. Check valve shall be pressurized to 4500 psig, held for two minutes. There shall be no deformation or leakage failure. Test will be observed and verified by inspection.

CHECK-OUT TEST: The check-out test is performed at the Mid-Body Umbilical Carrier Plate final assembly level per document No. ML0208-0040.

CERTIFICATION OR QUALIFICATION TESTS: The check valves are in compliance with Mid-Body Umbilical Carrier Plate document No. ML0208-0040 and are certified per Rockwell CR No. 33-580505-001B.

PRE-OPERATIONAL: During LH2 flow testing, hazardous gas detection equipment would indirectly detect check valve failure.

INSPECTION: Items are inspected for identification and damage. The check valve must meet the same cleanliness requirements as tube assemblies. The valves are disassembled for cleaning, and O-rings replaced as necessary prior to reassembly and pressure test. Despite the device's simplicity, it still has a repair kit so that consistent operation is maintained.

45-S70-0505-08-CV*-01 (Continued)

DATE: October 16, 1990

OPERATIONAL USE: Fluid line drain and purge to raise temperature and preclude leakage per V1040. Operations cannot continue safely without purge due to leakage tendency of LH₂.

Cryogenic fluid leakage is detected by hazardous gas detection system. Terminate and purge the fuel supply line if leakage exceeds 3.5% per launch commit criteria.

During servicing only, failure of the umbilical purge system will cause the carrier plate to reach cryogenic temperatures of -135°F (LO₂) and -400°F (LH₂) causing icing conditions on all umbilical surfaces resulting in malfunction of quick disconnects and mechanical release system. This condition is controlled by monitoring of the 750 PSIG GN₂/GHe supply pressure for the Facility tanks to verify GN₂/GHe flow.

FAILURE HISTORY: No failures of these devices have been reported in the PRACA system.