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S040244P
ATTACHMENT -
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FMEA #: 35-S70-0517-05-a-01

END ITEM EFFECTIVITY:

X	X	X
OV102	OV103	OV104

MODEL NO/NAME: S70-0517, LH₂ T-0 Umbilical Carrier Plate

ORBITER SUBSYSTEM: Aft Fuselage

PART NUMBER:	PART NAME:	REFERENCE DESIGNATION:	QUANTITY (PER SYSTEM)
259T-STT	Check Valve	---	2

CRITICALITY NUMBER: 1S

FUNCTION: Provide monodirectional He flow from purge manifold to 8 inch main LH₂ fill and drain QD purge can, 1 1/2-inch QD purge can.

CRITICAL FAILURE MODE: Stuck closed (loss of purge).

CAUSE: Mechanical shock

FAILURE EFFECT ON:

- (A) END ITEM: During fuel flow operations, H₂ gas may accumulate and escape from purge can; possible fire, damage to carrier plate, purge seals, fill and drain line.
- (B) INTERFACING SUBSYSTEM(S): Possible damage to ground LH₂ system if leaking H₂ ignites.
- (C) ORBITER: Loss of orbiter due to possible damage to orbiter exterior due to fire/explosion if leaking H₂ is ignited.
- (D) PERSONNEL: Loss of crew life due to potential fire/explosion.

HAZARDS: Cutoff of purge; possible fire/explosion if accompanied by leak of hydrogen gas.

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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. Proof is 1 1/2 times rated operating pressure and burst is 2 1/2 times rated operating pressure.

TEST:

ACCEPTANCE TESTS: Tests per Circle Seal Control part specification include: proof pressure, burst pressure, leakage, spring strength. Check valve shall be pressurized to 4,500 psig, held for two minutes. There shall be no deformation or leakage failure. Test will be observed and verified by inspection.

CHECK-OUT TESTS: The check-out test is performed at the Mid-Body Umbilical Carrier Plate final assembly level per document No. ML0208-0012.

CERTIFICATION OR QUALIFICATION TESTS: The check valve is in compliance with Mid-Body Umbilical Carrier Plate document ML0208-0012 and is certified per Rockwell CR No. 33-580529-001E.

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 has a repair kit so that consistent operation is maintained.

OPERATIONAL USE: Cutoff of liquid hydrogen flow through carrier plate to preclude leakage, icing. Securing of LH₂ system per S1014.

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Leakage can be detected by hazardous gas detection system. Terminate and purge 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 -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 GHe supply pressure for the Facility supply tanks to verify GHe flow.

FAILURE HISTORY: No failures of these devices have been reported.