

**SSME FMEA/CIL
REDUNDANCY SCREEN**

Component Group: Ducts and Lines
CIL Item: K544-01
Part Number: R0010747
Component: FPB ASI Purge Line
FMEA Item: K518, K544, K560, K561
Failure Mode: Fails to contain purge gas.

Prepared: D. Early
Approved: T. Nguyen
Approval Date: 7/25/00
Change #: 2
Directive #: CCBD ME3-01-5638

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| Phase | Failure / Effect Description | Criticality Hazard Reference |
|---|--|---------------------------------|
| P 4.1 | GN2 Leakage into aft compartment. Leakage causes loss of flow to downstream system reducing purge flow below acceptable limits for inerting propellant leakage at ICD limit. Potential open air fire. Loss of vehicle. | 1 ME-A1P |
| Redundancy Screens: SINGLE POINT FAILURE: N/A | | |

SSME FMEA/CIL
DESIGN

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Design / Document Reference

FAILURE CAUSE: A: Parent material failure or weld failure.

THE LINE ASSEMBLY (1) IS MANUFACTURED UTILIZING INCONEL 625 TUBE AND BAR. THE CHECK VALVE BODY AND CAP UTILIZE HAYNES 188 BAR. INCONEL 625 WAS SELECTED FOR ITS WELDABILITY, FORMABILITY, RESISTANCE TO STRESS CORROSION CRACKING, AND CORROSION RESISTANCE (2). INCONEL 625 POSSESSES THE REQUIRED STRENGTH WITHOUT REQUIRING HEAT TREAT (2). HAYNES 188 WAS SELECTED FOR ITS LOW CYCLE FATIGUE LIFE, WELDABILITY, AND CORROSION RESISTANCE (2). ALL MATERIALS USED IN THE LINE FABRICATION ARE LOX COMPATIBLE (2). FLANGE AND CHECK VALVE SECTIONS INCORPORATE RADIUS JOINTS TO REDUCE STRESS CONCENTRATIONS. OFFSET LIMIT REQUIREMENTS ARE ESTABLISHED TO REDUCE STRESS CONCENTRATIONS AND IMPROVE WELD GEOMETRY. TUBING STOCK IS DRAWN TO MAINTAIN SURFACE REGULARITY. INSTALLATION IS CONTROLLED FOR ANGULARITY AND OFFSET PER SPECIFICATION REQUIREMENTS (3). MINIMUM FACTORS OF SAFETY FOR THE LINE MEET CEI REQUIREMENTS (4). HIGH AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (5). THIS LINE ASSEMBLY WAS VERIFIED TO SATISFY PRESSURE CYCLING AND ULTIMATE PRESSURE DVS BY SIMILARITY TO THE RS007135 LINE ASSEMBLY (6). THE LINE ASSEMBLY PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (7). TABLE K544 LISTS ALL THE FMEA/CIL WELDS AND IDENTIFIES THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE, AND THOSE WELDS IN WHICH THE ROOT SIDE IS NOT ACCESSIBLE FOR INSPECTION. THESE WELDS HAVE BEEN ASSESSED AS ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (8).

(1) R0010747; (2) RSS-8582, RSS-8575; (3) RL00530; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B; (6) RSS-511-43; (7) NASA TASK 117; (8) RSS-8756

**SSME FMEA/CIL
INSPECTION AND TEST**

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| Failure Causes | Significant Characteristics | Inspection(s) / Test(s) | Document Reference |
|----------------|--|--|---|
| A | LINE ASSEMBLY BODY, CHECK VALVE CAP, CHECK VALVE FLANGE | | R0010747 RS008220 RS008213 RS007152 |
| | MATERIAL INTEGRITY | MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS. | R0010747 RS008220 RS008213 RS007152 |
| | | FLANGE AND DETAIL IS PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS. | RA0115-116 |
| | WELD INTEGRITY | ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE. | RL10011 RA0607-094 RA0115-116 RA0115-006 RA1115-001 RA0115-127 |
| | ASSEMBLY INTEGRITY | THE ASSEMBLY IS PROOF PRESSURE TESTED PER DRAWING REQUIREMENTS. | R0010747 |
| | FLIGHT FLOW TESTING | THE EXTERNAL SURFACE IS VISUALLY INSPECTED PRIOR TO EACH LAUNCH. (LAST TEST) | OMRSD V41BU0.030 |

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
 Reference: NASA letter SA21/88/308 and Rocketdyne letter 88RC09761.

Operational Use: Not Applicable.

**SSME E/CIL
WELD JOINTS**

Component Group: Ducts and Lines
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 Component: FPB ASI Purge Line
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| Component | Basic Part Number | Weld Number | Weld Type | Class | Root Side Not Access | Critical Initial Flaw Size Not Detectable | | Comments |
|---------------|-------------------|-------------|-----------|-------|----------------------------|---|-----|----------|
| | | | | | | HCF | LCF | |
| LINE | R0010747 | 1,2 | GTAW | I | X | X | X | |
| VALVE HOUSING | RS008059 | 1 | EB | I | X | | | |