

**SSME FMEA/CIL**  
**REDUNDANCY SCREEN**

Component Group: Ducts and Lines  
CIL Item: K112-01  
Part Number: R0010751  
Component: OPB ASI Fuel Supply Line  
FMEA Item: K111, K112, K113  
Failure Mode: Fails to contain hydrogen.

Prepared: D. Early  
Approved: T. Nguyen  
Approval Date: 7/25/00  
Change #: 1  
Directive #: CCBD ME3-01-5638

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Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Fuel leakage results in reduced flow to downstream system(s). Loss of fuel to ASI causes high mixture ratio erosion of ASI combustion chamber walls, manifold invasion, injector burnout, and LOX-rich operation. Overpressurization of aft compartment. Loss of vehicle.	1 ME-D3S,A,M,C
Redundancy Screens: SINGLE POINT FAILURE: N/A		

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**SSME 1 A/CIL**  
**DESIGN**

Component Group: Ducts and Lines  
CIL Item: K112-01  
Part Number: R0010751  
Component: OPB ASI Fuel Supply Line  
FMEA Item: K111, K112, K113  
Failure Mode: Falls to contain hydrogen.

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Design / Document Reference

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

THE LINE ASSEMBLY (1) IS MANUFACTURED UTILIZING INCONEL 625 TUBE AND BAR. INCONEL 625 WAS SELECTED FOR ITS RESISTANCE TO STRESS CORROSION CRACKING, CORROSION RESISTANCE, WELDABILITY, AND FORMABILITY (2). INCONEL 625 POSSESSES THE REQUIRED STRENGTH WITHOUT REQUIRING HEAT TREAT. INCONEL 625 IS NOT SIGNIFICANTLY EFFECTED BY HYDROGEN IN THIS ENVIRONMENT (2). FLANGE 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 (6). THE LINE ASSEMBLY PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (7). TABLE K112 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) R0010751; (2) RSS-8582; (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		R0010751
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	R0010751
		MACHINED DETAILS ARE 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.	R0010751
FLIGHT FLOW TESTING	THE EXTERNAL SURFACE IS VISUALLY INSPECTED PRIOR TO EACH LAUNCH. A HELIUM SIGNATURE LEAK TEST IS PERFORMED PRIOR TO EACH LAUNCH. (LAST TEST)	OMRSD V41BU0.030 OMRSD S00000.950	

**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    EA/CIL**  
**WELD JOINTS**

Component Group: Ducts and Lines  
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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	R0010751	1,2	GTAW	I	X	X		

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