

**SSME FM. CIL**  
**INSPECTION AND TEST**

Component Group: Ducts and Lines  
 CIL Item: K503-01  
 Part Number: RS007172  
 Component: Oxidizer System Purge Line  
 FMEA Item: K503  
 Failure Mode: Fails to contain purge gas.

Prepared: D. Early  
 Approved: T. Nguyen  
 Approval Date: 7/25/00  
 Change #: 2  
 Directive #: CCBDEME3-01-5638  
 Page: 1 of 1

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	LINE FITTING		RS007172 RS007278
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS007172 RS007278
		DETAILS ARE PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-116
	HEAT TREAT	HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RA0611-020
	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.	RS007172
	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 FMEA/CIL**  
**DESIGN**

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Page: 1 of 1

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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 321 CRES TUBE, INCONEL 625, AND INCONEL 718 BAR FOR THE FITTINGS. 321 CRES TUBING WAS SELECTED BECAUSE OF ITS STRENGTH, FABRICABILITY, GENERAL CORROSION RESISTANCE, AND STRESS CORROSION RESISTANCE (2). 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. INCONEL 718 WAS SELECTED FOR ITS STRENGTH, RESISTANCE TO STRESS CORROSION, CORROSION RESISTANCE, HIGH/LOW CYCLE FATIGUE CHARACTERISTICS, AND WELDABILITY (2). FLANGE AND FITTING 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 FOR THE LINE MEET CEI REQUIREMENTS (5). THE LINE ASSEMBLY HAS COMPLETED PRESSURE CYCLING AND ULTIMATE PRESSURE DVS TESTING (6). THE LINE ASSEMBLY PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (7). TABLE K503 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) RS007172; (2) RSS-8582; (3) RA1102-006; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B; (6) RSS-511-43; (7) NASA TASK 117; (8) RSS-8756

**SSME A/CIL**  
**REDUNDANCY SCREEN**

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Page: 1 of 1

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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.  Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-A1P, ME-A1A

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**SSME    EA/CIL**  
**WELD JOINTS**

Component Group:    Ducts and Lines  
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 Page:                 1 of 1

Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
LINE	RS007172	1,1a,2,2a	GTAW	I	X	X		