

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

Component Group: Ducts and Lines  
 CIL Item: K211-01  
 Part Number: RS007186  
 Component: OPB ASI Oxidizer Supply Line  
 FMEA Item: K210, K211  
 Failure Mode: Fails to contain GN2/oxidizer.

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

Phase	Failure / Effect Description	Criticality Hazard Reference
P 4.1	Loss of GN2 purge to FPB or OPB ASI oxidizer supply lines would reduce the purge flow below acceptable limits for inerting propellant leakage at ICD limits. Potential open air fire. Loss of vehicle.  Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-A1P
SMC 4.1	External leakage of an ASI oxidizer supply line will release LOX into the aft compartment that will mix with fuel-rich hot gas backflow from the ruptured ASI line resulting in a fire, overpressurization of aft compartment. Loss of vehicle.  Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-C3S, ME-C3M, ME-C3A,C

**SSME FMEA/CIL**  
**DESIGN**

Component Group: Ducts and Lines  
CIL Item: K211-01  
Part Number: RS007186  
Component: OPB ASI Oxidizer Supply Line  
FMEA Item: K210, K211  
Failure Mode: Fails to contain GN2/oxidizer.

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

Page: 1 of 1

---

Design / Document Reference

---

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

THE LINE ASSEMBLY (1) IS MANUFACTURED UTILIZING 321 CRES TUBE AND INCONEL 625 BAR FOR FLANGES, TEE, AND ORIFICE. MOUNT IS MANUFACTURED UTILIZING INCONEL 718 BAR. 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). ALL MATERIALS USED IN THE LINE FABRICATION ARE LOX COMPATIBLE (2). FLANGE, TEE, AND MOUNT 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). 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 K211 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) RS007186; (2) RSS-8582; (3) RL00530; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B; (6) SSME-81-0295; (7) NASA TASK 117; (8) RSS-8756

**SSME FMI CIL  
INSPECTION AND TEST**

Component Group: Ducts and Lines  
 CIL Item: K211-01  
 Part Number: RS007186  
 Component: OPB ASI Oxidizer Supply Line  
 FMEA Item: K210, K211  
 Failure Mode: Fails to contain GN2/oxidizer.

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

Page: 1 of 1

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	LINE	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS007186
	MOUNT		R0019162
	FLANGE		RS007152
	TEE		RS009530
	ORIFICE		RS009038
	MATERIAL INTEGRITY		RS007186
			R0019162
			RS007152
			RS009530
			RS009038
	THE DETAILS ARE PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-116	
HEAT TREAT	HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.	R0019162 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.	RS007186	
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 FMEA/CIL**  
**WELD JOINTS**

Component Group: Ducts and Lines  
 CIL Item: K211  
 Part Number: RS007186  
 Component: OPB ASI Oxidizer Supply Line  
 FMEA Item: K210, K211

Prepared: D. Early  
 Approved: T. Nguyen  
 Approval Date: 7/25/00  
 Change #: 1  
 Directive #: CCBD ME3-01-5638  
 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	RS007186	1	GTAW	I	X	X		
LINE	RS007186	2,3	GTAW	I	X			
LINE	RS007186	4	GTAW	I	X	X		
LINE	RS007186	5	GTAW	I	X	X		