

**SSME EA/CIL**  
**REDUNDANCY SCREEN**

Component Group: Ducts and Lines  
 CIL Item: K206-01  
 Part Number: RS007031  
 Component: FPB Oxidizer Supply Duct  
 FMEA Item: K206, K212  
 Failure Mode: Fails to contain oxidizer.

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

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Phase	Failure / Effect Description	Criticality Hazard Reference
PSMCD 4.1	Oxidizer leakage into aft compartment. Oxidizer leakage results in reduced flow to downstream system(s). Overpressurization of aft compartment. Loss of vehicle.  Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-C3P,D, ME-C3S, ME-C3M, ME-C3A,C

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

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Design / Document Reference

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

THE DUCT ASSEMBLY (1) IS MANUFACTURED UTILIZING INCONEL 718 TUBING AND INCONEL 718 BAR AND FORGING FOR FLANGE, ELBOW, MOUNT DETAILS. INCONEL 718 WAS SELECTED FOR ITS STRENGTH, RESISTANCE TO STRESS CORROSION, CORROSION RESISTANCE, HIGH/LOW CYCLE FATIGUE CHARACTERISTICS, AND WELDABILITY (2). MATERIALS ARE HEAT TREATED TO DEVELOP FULL MATERIAL STRENGTH AND HARDNESS. ALL MATERIALS USED IN THE DUCT FABRICATION ARE LOX COMPATIBLE (2). FLANGE SECTIONS AND MOUNT 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 (3). MINIMUM FACTORS OF SAFETY FOR THE DUCT MEET CEI REQUIREMENTS (4). HIGH AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (5). THE DUCT ASSEMBLY HAS COMPLETED PRESSURE CYCLING AND ULTIMATE PRESSURE DVS TESTING (6). THE DUCT ASSEMBLY PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (7). TABLE K206 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) RS007031; (2) RSS-8575, RSS-8582; (3) I.L. 2126-8046; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B; (6) RSS-511-43; (7) NASA TASK 117; (8) RSS-8756

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

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	DUCT		RS007031
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS007031
	HEAT TREAT	HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RA0611-020
	ASSEMBLY INTEGRITY	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.	RS007031
		EXTERIOR SURFACE OF DUCT IS INSPECTED FOR EXCESSIVE SURFACE DEFECTS PER DRAWING REQUIREMENTS.	RS007031
		CIRCUMFERENTIAL AND LONGITUDINAL WELDS ARE PENETRANT INSPECTED AFTER PROOF TEST PER SPECIFICATION REQUIREMENTS.	RA0115-116
	FLIGHT FLOW TESTING	THE EXTERNAL SURFACE IS VISUALLY INSPECTED PRIOR TO EACH LAUNCH.	OMRSD V41BU0.030
		A HELIUM SIGNATURE LEAK TEST IS PERFORMED PRIOR TO EACH LAUNCH. (LAST TEST)	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  
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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	
DUCT	RS007031	1	GTAW	I				
DUCT	RS007031	2	GTAW	I	X	X		
DUCT	RS007031	3	GTAW	I	X	X		
DUCT	RS007031	4	GTAW	I				