

SSME EA/CIL
REDUNDANCY SCREEN

Component Group: Ducts and Lines
 CIL Item: K212-01
 Part Number: RS007032
 Component: OPB 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 #: CCBd ME3-01-5638
 Page: 1 of 1

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

Component Group: Ducts and Lines
CIL Item: K212-01
Part Number: RS007032
Component: OPB 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 #: CCBd ME3-01-5638

Page: 1 of 1

Design / Document Reference

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

THE DUCT ASSEMBLY (1) IS MANUFACTURED UTILIZING INCONEL 718 AND INCONEL 625 TUBING FOR TEE, AND FLANGE DETAILS. INCONEL 718 WAS SELECTED FOR ITS STRENGTH, RESISTANCE TO STRESS CORROSION, CORROSION RESISTANCE, HIGH/LOW CYCLE FATIGUE CHARACTERISTICS, AND WELDABILITY (2). INCONEL 718 MATERIALS ARE HEAT TREATED TO DEVELOP FULL MATERIAL STRENGTH AND HARDNESS (2). INCONEL 625 WAS SELECTED FOR ITS WELDABILITY, FORMABILITY, RESISTANCE TO STRESS CORROSION CRACKING, AND CORROSION RESISTANCE (2). ALL MATERIALS USED IN THE DUCT FABRICATION ARE LOX COMPATIBLE (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 (3). MINIMUM FACTORS OF SAFETY FOR THE DUCT MEET CEI REQUIREMENTS (4). HIGH AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (5). THIS DUCT ASSEMBLY WAS VERIFIED TO SATISFY PRESSURE CYCLING AND ULTIMATE PRESSURE DVS BY SIMILARITY (6). THE DUCT ASSEMBLY PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (7). TABLE K212 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) RS007032; (2) RSS-8582; (3) RL00630, I.L. 2126-8046; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B; (6) RSS-511-43; (7) NASA TASK 117; (8) RSS-8756

**SSME FW /CIL
INSPECTION AND TEST**

Component Group: Ducts and Lines
 CIL Item: K212-01
 Part Number: RS007032
 Component: OPB 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 #: CCBD ME3-01-5638

Page: 1 of 1

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference	
A	DUCT		RS007032	
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS007032	
	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 DETAILS ARE PROOF PRESSURE TESTED PER DRAWING REQUIREMENTS.		RS007032
		FILLET RADIUS AT THE TRANSITION AREAS ARE VERIFIED PER SPECIFICATION REQUIREMENTS.		RA1103-001
		EXTERIOR SURFACE OF DUCT IS INSPECTED FOR SURFACE DEFECTS PER DRAWING REQUIREMENTS.		RS007032
		THE ASSEMBLY IS PROOF PRESSURE TESTED PER DRAWING REQUIREMENTS.		RS007032
	FLIGHT FLOW TESTING	AFTER PROOF PRESSURE TEST WELDS ARE PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.		RA0115-116
		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: K212
 Part Number: RS007032
 Component: OPB Oxidizer Supply Duct
 FMEA Item: K206, K212

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	
DUCT	RS007032	1	GTAW	I				
DUCT	RS007032	2	GTAW	I				
DUCT	RS007032	3	GTAW	I		X		
DUCT	RS007032	4	GTAW	I				