

**SSME FMEA/CIL  
REDUNDANCY SCREEN**

Component Group: Combustion Devices  
CIL Item: A700-10  
Part Number: RS009004  
Component: Oxidizer Preburner  
FMEA Item: A700  
Failure Mode: External rupture.

Prepared: A. Kay  
Approved: T. Nguyen  
Approval Date: 9/9/99  
Change #: 1  
Directive #: CCBD ME1-01-5238

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Phase	Failure / Effect Description	Critical ly Hazard Reference
SMC 4.1	Leakage into the aft compartment will cause overpressurization and/or fire. Loss of vehicle.  Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-B55, ME-B6A,C, ME-B6M

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SSME F/A/CIL  
DESIGN

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Failure Mode: External rupture.

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Approval Date: 8/9/89  
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Design / Document Reference

FAILURE CAUSE: A: Weld or parent material failure.

THE DOME IS CONSTRUCTED OF INCONEL 718. THE STRENGTH OF INCONEL 718 AFTER HEAT TREATMENT IS THE PRIMARY REASON FOR ITS SELECTION. OTHER DESIRABLE PROPERTIES OF INCONEL 718 ARE ITS CRYOGENIC DUCTILITY AND OXYGEN COMPATIBILITY (1). THE ASI OXIDIZER SUPPLY LINES AND INTERPROPELLANT PLATE ARE MADE OF INCONEL 625. INCONEL 625 IS READILY WELDED TO INCONEL 718 AND HAS GOOD RESISTANCE TO STRESS CORROSION, GOOD CRYOGENIC DUCTILITY, AND OXYGEN COMPATIBILITY (1). PRIMARY STRESS FACTORS OF SAFETY MEET CEI REQUIREMENTS (2). HIGH CYCLE FATIGUE AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (3). THE PREBURNER PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/IDE FLAW GROWTH SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (4). THE FMEA/CIL WELDS ARE CLEARED FOR FRACTURE MECHANICS/IDE FLAW GROWTH BY THE WELD ASSESSMENT (5). TABLE A700 LISTS ALL 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. THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE ARE ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (6). DURING TEARDOWN OF THE 2010 FUEL PREBURNER INJECTOR, A VOID WAS IDENTIFIED IN THE ELECTRON BEAM WELD BETWEEN THE DOME AND INTERPROPELLANT PLATE. MF & T ANALYSIS SHOWED NO FATIGUE GROWTH. (NOTE THE FUEL PREBURNER AND OXIDIZER PREBURNER ARE THE SAME IN THIS AREA) (7). THE PREBURNER WAS DVS TESTED (6).

(1) RSS-8571-9; (2) RSS-8548, CP320R0003B; (3) RI00512, CP320R0003B; (4) NASA TASK 117; (5) RSS-8756; (6) DVS-305; (7) MPR-86-0889

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**SSME FMEA/GIL  
INSPECTION AND TEST**

Component Group: Combustion Devices  
 CIL Item: A700-10  
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 FMEA Item: A700  
 Failure Mode: External rupture.

Prepared: A. Kay  
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference	
A	DOME		RS009005 RS009036 RS009529 RS009028 RS009014 RS009018 RS009096 R0011053	
	ASI OXIDIZER INLET			
	ASI OXIDIZER FLANGE			
	INTERPROPELLANT PLATE			
	OXIDIZER INLET ASSY			
	INSERT ASSY			
	FLANGE			
	LINE			
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.		RB0170-153 RB0170-213
		ULTRASONIC INSPECTION IS PERFORMED ON THE FORGINGS PER SPECIFICATION REQUIREMENTS.		RA0115-012
		PENETRANT INSPECTION OF THE MACHINED DOME VERIFIES NO CRACKS		RA0115-116
		TUBING IS ULTRASONIC AND PENETRANT INSPECTED (OUTER DIAMETER) FOR DEFECTS PER SPECIFICATION REQUIREMENTS.		RB0170-213 RA0115-124 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 RAC007-034 RA0115-116 RA0115-036 RA0115-127 RA1115-031
		A SPECIAL INSPECTION OF THE INNER AND EXTERIOR CIRCUMFERENTIAL DOME WELDS IS PERFORMED (INCLUDING: BORING, ETCH, PENETRANT, AND PLUG WELDING)		RL00456 RL00256
ASSEMBLY INTEGRITY	PROOF PRESSURE TEST IS PERFORMED ON THE ASI ASSEMBLY.		RL00177 RI00241 RI00287	
	A PENETRANT INSPECTION AFTER PRESSURE TEST VERIFIES NO CRACKS.		RA0115-116	
	THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY PREBURNER INTEGRITY.		RL00050-04 RL00050-06 RI00056-07	
	THE HELIUM SIGNATURE LEAK TEST PERFORMED PRIOR TO EACH LAUNCH VERIFIES DOME INTEGRITY. (LAST TEST)		OMRSD S30000.950	

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
Failure History	Comprehensive failure history data is maintained in the Problem Reporting database (FRAMS/PRACA) Reference: NASA letter SA21683308 and Rocketdyne letter RRRC0976.		
Operational Use:	Not Applicable.		

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**SSME FMEA/CIL  
WELD JOINTS**

Component Group: Combustion Devices  
 CIL Item: A700  
 Component: RS009004  
 Part Number: Oxidizer Preburner  
 A700

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 Approved: T. Nguyen  
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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	
OPB CHAMBER	RS009003	1,2	GTAW	I	X	X	X	(A050)
OPB CHAMBER	RS009003	1(60DEG)	GTAW	II	X	X	X	(A050)
OPB INJECTOR	RS009004	1	EBW	II	X	X	X	
OPB INJECTOR	RS009004	2	EBW	I	X			
OPB INJECTOR	RS009004	3	GTAW	I	X			
OPB INJECTOR	RS009004	9	EBW	II	X			
OPB INJECTOR	RS009004	28	FBW	II	X			
OPB INJECTOR	RS009004	29	EBW	II	X			
OPB BODY	RS009007	1	GTAW	II	X			(A050)
OPB BODY	RS009007	2	EBW	II	X			(A050)
OPB BODY	RS009007	3	EBW	I				(A050)
OPB BODY	RS009007	4 (OPT)	GTAW	I	X			(A050)
OPB BODY	RS009007	10,11	GTAW	I	X	X	X	(A050)
OPB BODY	RS009007	12	GTAW	I	X		X	(A050)
OPB BODY	RS009007	13	GTAW	I	X	X	X	(A050)
OPB BODY	RS009007	14	GTAW	I	X	X	X	(A050)
OPB BODY	R0018067	1	GTAW	II	X	X	X	
OPB BODY	R0018067	2	EBW	I	X			
OPB BODY	R0018067	6	GTAW	I	X			
OPB BODY	R0018067	7	GTAW	I	X			
OPB FUEL MANIFOLD	RS009013	9(OPT)10 (OPT)	GTAW	I		X	X	(A050)
OPB FUEL MANIFOLD	RS009013	11 (OPT)	GTAW	I		X	X	(A050)
OPB FUEL MANIFOLD	RS009013	13 (OPT)	GTAW	I	X			(A050)
OPB OXID INLET	RS009014	6-8	GTAW	I		X		
OPB LINER	RS009015	2-17	GTAW	II	X			(A050)
OPB ASI FUEL LINE	RS009024	1	GTAW	I	X	X	X	(A050)
OPB CHAMBER	RS009003	3 (OPT) 4 (OPT)	GTAW	I		X	X	(A050)
OPB CHAMBER	RS009003	5 (OPT)	GTAW	I		X	X	(A050)
OPB CHAMBER	RS009003	6 (OPT)	GTAW	I	X			