

**SSME / FA/CIL  
REDUNDANCY SCREEN**

Component Group: Combustion Devices  
CIL Item: A600-12  
Part Number: RS009020  
Component: Fuel Preburner  
FMFA Item: A600  
Failure Mode: Omega joint failure.

Prepared: A. Kay  
Approved: T. Nguyen  
Approval Date: 9/9/99  
Change #: 1  
Directive #: CCBO ME3-C1-6239

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Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Loss of the joint causes oxidizer rich operation across the injector face and turbine failure. Loss of vehicle.  Redundancy Screens: SINGLE POINT FAILURE N/A	1 NE-B2S, ME-B2A C, MF B2M

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**SSW/FMEA/CIL**  
**DESIGN**

Component Group: Combustion Devices  
CIL Item: A600-12  
Part Number: RSC09020  
Component: Fuel Preburner  
FMEA Item: A600  
Failure Mode: Omega joint failure.

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Design / Document Reference

**FAILURE CAUSE:** A- Failure of parent material or weld.

INCONEL 625 WAS SELECTED FOR THE PREBURNER EXPANSION JOINT BECAUSE OF ITS WELDABILITY, MACHINABILITY AND MATERIAL PROPERTIES (1). THE JOINT IS NOT SUSCEPTABLE TO HYDROGEN EMBRITTLEMENT DUE TO LOW STRAINS IN THE MATERIAL. THE EXPANSION JOINT CONSISTS OF AN INTERNAL AND EXTERNAL RING CONNECTED BY A METAL U-CHANNEL (2) WHICH ALLOWS THE DISTANCE BETWEEN THE TWO RINGS TO EXPAND AND CONTRACT WITH THE FACEPLATE RADIAL AND AXIAL MOVEMENT. THE EFFECT OF SMALL LEAKAGE AT THE EXPANSION JOINT IS NOT DETRIMENTAL IN VIEW OF THE AMOUNT OF FUEL THAT IS PASSED THROUGH THE FACEPLATE AND BEHIND THE LINER (3). HIGH CYCLE FATIGUE LIFE, LOW CYCLE FATIGUE LIFE, AND THE MINIMUM FACTORS OF SAFETY MEET CCI REQUIREMENTS (4). THE EXPANSION JOINT PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH SINCE IT IS NOT A FRACTURE CRITICAL PART (5). THE FMEA/CIL WELDS ARE CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH BY THE WELD ASSESSMENT (6). TABLE A600 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). THE PREBURNER WAS DVS TESTED (7).

(1) RSS-8571-B; (2) RSC09032; (3) RSC07051; (4) R100532 GP320R0003B RSS-8546; (5) NASA TASK 117; (6) RSS-8756; (7) DVS-306

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**SSME FME :IL  
INSPECTION A...J TEST**

Component Group: Combustion Devices  
 CIL Item: A600-12  
 Part Number: RS009020  
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 FMEA Item: A600  
 Failure Mode: Omega joint failure.

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	EXPANSION JOINT		RS009020
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS. EXPANSION JOINT IS PENETRANT INSPECTED AFTER COMPLETION 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.  TEST SAMPLE WELDS ARE MADE FOR RS007051 WELDS 15 AND 16 TO VERIFY WELD PROCESS CONTROLS AND GEOMETRY	RL10011 RA0607-034 RA0115-116 RA0115-056 RA0115-127 RA1115-001 RA0607-034
	ASSEMBLY INTEGRITY	THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY OMEGA JOINT INTEGRITY.  THE PREBURNER FACE IS INSPECTED PRIOR TO LAUNCH. (LAST TEST)	RI 00050-04 RL00356-06 RL00356-07 OMRSD V419J0 040

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Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)  
 Reference: NASA letter SA21/88/306 and Rocketdyne letter 88RC09761  
 Operational Use: Not Applicable.

**SSME F A/CIL  
WELD JOINTS**

Component Group: Combustion Devices  
 CIL Item: A600  
 Component: RS009020  
 Part Number: Fuel Preburner  
 A600

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Component	Basic Part Number	Weld Number	Weld Type	Class	Access	Critical Initial Flaw Size Not Detectable		Comments
						Root Side Not	HCF LCF	
FPB CHAMBER	RS009019	1,2	GTAW	I	X	X	X	
FPB INJECTOR	RS009020	1	EBW	1b	X	X	X	
FPB INJECTOR	RS009020	2	EBW	1f	X			
FPB INJECTOR	RS009020	3	GTAW	I	X	X	X	
FPB INJECTOR	RS009020	9	EBW	1f	X			
FPB INJECTOR	RS009020	38	EBW	1f	X			
FPB INJECTOR	RS009020	39	EBW	1f	X			
FPB BODY	RS009023	1 (OPT)	GTAW	I	X			(AC50)
FPB BODY	RS009023	5	EBW	I	X			(AC50)
FPB FUEL MANIFOLD	RS009029	7 (OPT), 8 (OPT)	GTAW	I		X	X	(AC50)
FPB FUEL MANIFOLD	RS009029	11 (OPT)	GTAW	I		X		(AC50)
FPB FUEL MANIFOLD	RS009029	13 (OPT)	GTAW	I		X		(AC50)
FPB OXID INLET	RS009030	1	GTAW	I		X		
FPB OXID INLET	RS009030	2	GTAW	I	X	X	X	
FPB OXID INLET	RS009030	4	GTAW	I				
PREBURNER EXPANSION JOINT	RS009032	1	GTAW	I				
PREBURNER EXPANSION JOINT	RS009032	2,3	GTAW	II	X			
FPB ASH FUEL LINE	RS009026	1 PLC	GTAW	I	X			
FPB CHAMBER	RS009019	3 (OPT), 4 (OPT)	GTAW	I		X	X	(AC50)
FPB CHAMBER	RS009019	5 (OPT)	GTAW	I		X		(AC50)
FPB CHAMBER	RS009019	6 (OPT)	GTAW	I		X		(AC50)

**SSME FMEA/CIL  
FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE**

Component Group: Combustion Devices  
 Item Name: Fuel Preburner  
 Item Number: A603  
 Part Number: RS009920

Prepared: A. Kay  
 Approved: T. Nguyen  
 Approval Date: 9/9/99  
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Base Line Rationale	Variance	Change Rationale	Variant Dash Number
1. A603- NO RATIONALE EFFECTED.	MDLY LINER IS INSTALLED IN VARIOUS PREBURNER ASSEMBLIES.	LINER MAY BECOME DAMAGED. USE AS IS RATIONALE; DEBONDED LINER HAS BEEN DETERMINED TO BE A CRITICALITY THREE.	RS007051-1441 RS007051-1457

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