

**SSME I A/CIL
REDUNDANCY SCREEN**

Component Group: Combustion Devices
 CIL Item: A605-09
 Part Number: R0017438
 Component: Fuel Preburner (Phase II+)
 FMEA Item: A605
 Failure Mode: Inter-propellant plate or element-to-plate braze joint leakage.

Prepared: A. Kay
 Approved: T. Nguyen
 Approval Date: 9/9/99
 Change #: 2
 Directive #: CCBD ME3-01 5238

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Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	<p>ignition of the mixed propellants at the leakage point causing erosion and/or ice production in the manifold having the lowest pressure. Contamination by ice or injector erosion causes propellant maldistribution and burnout of turbines and other components within or downstream of the combustion chamber. Loss of vehicle</p> <p>Redundancy Screens: SINGLE POINT FAILURE: N/A</p>	<p>1 ME-FB2S, ME-FB2M ME-FB2A,C</p>

SSME FMEA/CIL
DESIGN

Component Group: Combustion Devices
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Design / Document Reference

FAILURE CAUSE: A: Braze joint or Interpropellant plate failure.

THE PHASE II* INJECTION ELEMENTS ARE FABRICATED FROM 304L CRES WHICH IS RESISTANT TO HYDROGEN EMBRITTEMENT AND OXYGEN FLAMEABILITY (1). IT HAS GOOD BRAZABILITY, AND IS CONDUSIVE TO CREATING HIGH INTEGRITY BRAZE BONDS. THE INTERPROPELLANT PLATE IS MADE OF INCONEL 625. INCONEL 625 WAS SELECTED FOR ITS BRAZABILITY AND MACHINABILITY. INCONEL 625 IS DUCTILE AT CRYOGENIC TEMPERATURES AND IS LOX COMPATIBLE. THE FACEPLATE IS SUFFICIENTLY DUCTILE AND SUBJECTED TO MINOR STRAIN LEVELS MAKING IT STABLE IN A HYDROGEN ENVIRONMENT (1). CLOSE TOLERANCES ON THE ELEMENTS AND FACEPLATE TO INSURE SATISFACTORY BRAZE BONDING (2)(3). THE BRAZING OPERATION IS CONTROLLED BY SPECIFICATION REQUIREMENTS (4). PREBURNERS ARE SCREENED FOR BOTH FABRICATION AND CUTOFF POP RELATED FACEPLATE DEFORMATION BY VERIFYING FACEPLATE FLATNESS IN ACCORDANCE WITH SPECIFICATION REQUIREMENTS (5). PRIMARY STRESS FACTORS OF SAFETY MEET CEI REQUIREMENTS (6). HIGH CYCLE FATIGUE LIFE AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (7). THE INTERPROPELLANT PLATE'S PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (8). THE FMEACIL WELDS ARE CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH BY THE WELD ASSESSMENT (9). TABLE A605 LISTS ALL FMEACIL 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 (9). THE PREBURNER WAS DVR TESTED (10).

(1) RSS-8571-10; (2) R0017438; (3) R0017421; (4) RA1607-007, RA1607-017; (5) RL00050-04, RL00525; (6) RSS-8546, CP320R0003B; (7) RL00532, CP320R0003B; (8) NASA TASK 117; (9) RSS-8755; (10) RSS-6879-1

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SSME FME CA
INSPECTION AND TEST

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Failure Causes	Signifcant Characteristics	Inspection(s) / Test(s)	Document Reference	
A	PIN, BAFFLE INJECTION ELEMENT INTERPROPELLANT PLATE	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS009326 R0017421 RS009024 R0017421 RS009024 RS009026
			THE INTERPROPELLANT PLATE IS ULTRASONICALLY INSPECTED BEFORE MACHINING PER SPECIFICATION REQUIREMENTS.	RA0115-012
			THE INTERPROPELLANT PLATE IS PENETRANT INSPECTED BEFORE AND AFTER MACHINING 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 RA1607-071 RA0115-116 RA0115-026 RA0115-127 RA1115-031	
	BRAZE INTEGRITY	BRAZE OPERATION IS CONTROLLED BY SPECIFICATION REQUIREMENTS AND THE BRAZE ALLOY IS TRACEABLE TO CERTIFICATIONS. BAFFLES ARE FLOW CHECKED AFTER BRAZING PER SPECIFICATION REQUIREMENTS.	RA1607-007 RB0170-160 RL00568	
	ASSEMBLY INTEGRITY	ASSEMBLY JOINTS ARE LEAK CHECKED, PENETRANT INSPECTED, AND INSPECTED VISUALLY AFTER BRAZING TO INSURE 360 DEGREES OF ALLOY FILLET THE INJECTOR ASSEMBLY IS PRESSURE TESTED AFTER BRAZING, WELDING, AND INSTALLATION.	R0017428 RA0115-110 RA1607-007 R0018001 RL00846	
		PREBURNER INJECTOR FACEPLATE FLATNESS IS VERIFIED PER DRAWING AND SPECIFICATION REQUIREMENTS.	R0018000 RL00525	
		THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY ASSEMBLY INTEGRITY (LAST TEST).	RL00053-01 RL00056-06 RL00053-07	

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Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
 Reference: NASA letter SA21/88/308 and Rockwell letter 58RC09761.
 Operational Use: Not Applicable.

**SSME FMEA/CIL
WELD JOINTS**

Component Group: Combustion Devices
 CIL Item: A605
 Component: R0017438
 Part Number: Fuel Preburner (Phase II-)
 A605

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Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side No: Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
FPB BODY	R0017426	1	EBW	I		X		
FPB BODY	R0017426	2	EBW	I	X			
FPB BODY	R0017426	3	EBW	I	X			
FPB FUEL CHAMBER	R0017435	1	GTAW	I	X	X	X	
FPB FUEL CHAMBER	R0017435	2	GTAW	I	X	X	X	
FPB INJECTOR	R0017438	1	EBW	II	X	X	X	
FPB INJECTOR	R0017438	2	EBW	II	X	X	X	
FPB INJECTOR	R0017438	3	GTAW	II	X			
FPB INJECTOR	R0017438	5	EBW	II	X	N/A	N/A	
FPB INJECTOR	R0017438	39	EBW	II	X	N/A	N/A	
FPB INJECTOR	R0017438	39	EBW	II	X	X	X	
FPB FUEL MANIFOLD	RS009029	7(OPT), 8(OPT)	GTAW	I		X	X	
FPB FUEL MANIFOLD	RS009029	11(OPT)	GTAW	I		X		
FPB FUEL MANIFOLD	RS009029	13(OPT)	GTAW	I		X		
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 ASI FUEL LINE	RS009525	1 PLC	GTAW	I	X			

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SSME F A/CIL
FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

Component Group: Combustion Devices
 Item Name: Fuel Preburner (Phase II+)
 Item Number: A605
 Part Number: R0317438

Prepared: A. Kay
 Approved: T. Nguyen
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Base Line Rationale	Variance	Change Rationale	Variant Dash Number
1. A605 NO RATIONALE EFFECTED	902 WELD OVERLAY EXISTS ON ONE PREBURNER ASSEMBLY.	OVERLAY WAS APPLIED TO PROVIDE HYDROGEN EMBRITTELEMENT PROTECTION. USE AS IS RATIONALE: ANALYSIS SHOWED NO HEE PROTECTION REQUIRED.	R0317438-51
2. A605-9,-10,-11. NO RATIONALE EFFECTED	POWERHEADS EXIST UTILIZING THE COMBINED FOUR ZONE PROOF PRESSURE TEST FROM THE HOT GAS MANIFOLD. CEI REQUIREMENTS ARE MAINTAINED.	HOT GAS MANIFOLD PROOF PRESSURE TEST ACCOMPLISHED SEPARATELY PRIOR TO COOLANT DUCT AND MAIN INJECTOR INSTALLATION.	R0019201-681, -701, -731 -991, 1051.

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