

**SSME FMEA/CIL  
REDUNDANCY SCREEN**

Component Group: Combustion Devices  
 CIL Item: A505-10  
 Part Number: R0017438  
 Component: Fuel Preburner (Phase II\*)  
 FMEA Item: A505  
 Failure Mode: External rupture.

Prepared: A. Kay  
 Approved: T. Nguyen  
 Approval Date: 9/9/99  
 Change #: 2  
 Directive #: CCB0 ME3-01 5238

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Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Leakage into the aft compartment will cause overpressurization, fire. Loss of vehicle.  Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-FB2S ME-FB2M, ME-FB2A,C

SSME FMEA/CIL  
DESIGN

Component Group: Combustion Devices  
CIL Item: A805-10  
Part Number: RDB17438  
Component: Fuel Preburner (Phase II+)  
FMEA Item: A805  
Failure Mode: External rupture.

Prepared: A. Kay  
Approved: T. Nguyen  
Approval Date: 9/8/93  
Change #: 2  
Directive #: CCBD ME3-01-5238

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Design / Document Reference

**FAILURE CAUSE:** A: Weld or parent material failure.

THE FUEL PREBURNER COME AND OXIDIZER INLET ARE FABRICATED 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 INTERPROPELLANT PLATE IS FABRICATED FROM INCONEL 525. INCONEL 525 IS READILY WELDED TO INCONEL 718 AND EXHIBITS RESISTANCE TO STRESS CORROSION, CRYOGENIC DUCTILITY, AND OXYGEN COMPATIBILITY (1). PRIMARY FACTORS OF SAFETY MEET CEI REQUIREMENTS (2). HIGH CYCLE FATIGUE AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (3). OFFSET LIMIT REQUIREMENTS ARE ESTABLISHED TO REDUCE STRESS CONCENTRATIONS AND IMPROVE WELD GEOMETRY (4). CRITICAL WELD BEADS ARE MACHINED FLUSH TO REDUCE STRESS CONCENTRATIONS. THE PREBURNER PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH SINCE THEY CONTAIN NO FRACTURE CRITICAL PARTS (5). THE FMEA/CIL WELDS ARE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH BY THE WELD ASSESSMENT. TABLE A805 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 DFR TESTED (7).

(1) RSS-8571-10; (2) RSS-8546, CP320P0003B; (3) RL00532, CP320RC003B, (4) RL10011; (5) NASA TASK 117; (6) RSS-5750; (7) RSS-8879-1

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**DOMIC FINEARTS**  
**INSPECTION AND TEST**

Component Group: Combustion Devices  
 CIL Item: A605-10  
 Part Number: R0017438  
 Component: Fuel Preburner (Phase II+)  
 FMEA Item: A885  
 Failure Mode: External rupture.

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

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	OXIDIZER INLET		R0017427
	OXIDIZER INLET FLANGE		R0017437
	OXIDIZER DOME		RS009021
	INTERPROPELLANT PLATE		RS009024
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RB0170-163
		ULTRASONIC INSPECTION IS PERFORMED ON THE FORGINGS PER SPECIFICATION REQUIREMENTS.	RA0115-012
		A PENETRANT INSPECTION OF THE MACHINED DOME AFTER HEAT TREAT PRIOR TO FINAL MACHINING VERIFIES NO CRACKS.	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	RL10311 RA1607-071 RA0115-116 RA0115-006 RA0115-127 RA1115-001
		LOX INLET ELBOW WELD FACE AND ROOT SIDE GEOMETRY IS VERIFIED PER DRAWING REQUIREMENTS.	R0018020
	A SPECIAL INSPECTION OF THE INNER AND EXTERIOR CIRCUMFERENTIAL DOME WELDS IS PERFORMED (INCLUDING: BORING, ETCH, VISUAL, AND PLUG WELDING) PER DRAWING AND SPECIFICATION REQUIREMENTS.	R0017438 RL00255 R0018020 RL00758	
ASSEMBLY INTEGRITY	AN ASSEMBLY LEAK CHECK AND PROOF PRESSURE TEST ARE PERFORMED PER DRAWING AND SPECIFICATION REQUIREMENTS.	R0017438 R0018001 RL00845	
	A PENETRANT INSPECTION AFTER PRESSURE TEST VERIFIES NO CRACKS.	RA0115-116 RF0301-120	
	THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY INTEGRITY OF PREBURNER	RL00053-04 RL00053-05 RL00053-07	
	THE HELIUM SIGNATURE LEAK TEST PERFORMED PRIOR TO EACH FLIGHT VERIFIES DOME INTEGRITY (LAST TEST).	DMRSD-SU0030.050	

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Component p: Combustion Devices  
CIL Item: A605-10  
Part Number: R0017438  
Component: Fuel Preburner (Phase II+)  
FMEA Item: A605  
Failure Mode: External rupture.

Proposed: [blank]  
Approved: T. Nguyen  
Approval Date: 9/8/99  
Change #: 2  
Directive #: CCBD ME3-01-5238

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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 SA21/B6/308 and Rocketdyne letter 68RCC9761		
Operational Use	Not Applicable.		

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**SSME FMEA/CIL  
WELD JOINTS**

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

Prepared: A. Kay  
 Approved: T. Nguyen  
 Approval Date: 9/9/99  
 Change #: 1  
 Directive #: CCBD ME3-01-5238  
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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  
 Approval Date: 9/8/99  
 Change #: 2  
 Directive #: CCRD ME3-01 5238

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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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