

**SSME I A/CIL
REDUNDANCY SCREEN**

Component Group: Combustion Devices
 CIL Item: A605-02
 Part Number: R0017438
 Component: Fuel Preburner (Phase II*)
 FMEA Item: A605
 Failure Mode: Loss of fuel to the ASI

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

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Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Loss of fuel to the ASI causes high mixture ratio erosion of the ASI combustion chamber walls. Injector burnout, loss of turbine and subsequent engine failure. 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: A505-02
Part Number: R001743a
Component: Fuel Preburner (Phase II+)
FMEA Item: A505
Failure Mode: Loss of fuel to the ASI

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Design / Document Reference

FAILURE CAUSE: A: Contamination of the ASI fuel orifice or passage.

THE FUEL ASI DELIVERY SYSTEM IS DESIGNED TO REMOVE ANY PARTICLES THAT MAY CAUSE CUTOFF OR PARTIAL BLOCKAGE OF THE PASSAGES. A FILTER IS LOCATED AT THE HEAD OF THE DELIVERY SYSTEM THAT REMOVES PARTICLES FROM THE FUEL THAT MAY BE LARGE ENOUGH TO CAUSE A REDUCTION IN FUEL FLOW (1). THE FILTER IS DESIGNED TO STOP PARTICLES IN THE FUEL AND ALLOW THEM TO SETTLE OFF THE FILTER FACE (2). THIS ALLOWS FOR PARTICLE REMOVAL WITHOUT FILTER FLOW REDUCTION SHOULD GROSS CONTAMINATION OCCUR. THE FILTER CAN WITHSTAND PLUGGING OF OVER HALF OF ITS SURFACE AREA PRIOR TO A REDUCTION IN ASI CHAMBER FUEL DELIVERY. THE ASI CAN OPERATE OVER A VERY WIDE MIXTURE RATIO RANGE AND PARTIAL BLOCKAGE CAN STILL ALLOW TIMELY IGNITION OF THE PROPELLANTS. THE FUEL SUPPLY IS FILTERED TO 400-MICRONS AT THE EXTERNAL TANK PRIOR TO USE BY THE MAIN ENGINES (3). THE ASI FUEL FILTER IS FABRICATED FROM INCONEL 625 ALLOY WHICH WAS SELECTED BECAUSE OF ITS BRAZEABILITY, WELDABILITY, MACHINABILITY, AND MATERIAL PROPERTIES (4). INCONEL CAN BE BRAZED WITHOUT PLATING IN A CONTROLLED ATMOSPHERE. THE FUEL FILTER IS BRAZED IN EITHER HYDROGEN, ARGON AND HELIUM, HELIUM, OR VACUUM (5). THE ASI FUEL FILTER HAS BEEN ANALYZED FOR FLOW INDUCED LOADS, DYNAMIC LOADS AND PRESSURE LOADS AND MEET THE HIGH CYCLE AND LOW CYCLE FATIGUE LIFE CEI REQUIREMENTS (6). THE MINIMUM FACTORS OF SAFETY FOR THE ASI FUEL FILTER MEET CEI REQUIREMENTS (7). THE ASI IGNITION SYSTEM HAS BEEN DESIGNED AND VERIFICATION TESTED FOR LOW PRESSURE IGNITION AND LOW MIXTURE RATIOS (8). DESIGN TESTING OF THE FILTER WITH INDUCED CONTAMINATION OF THE PHASE II POWERHEAD SHOWED THE FLOW WASHES THE FILTER. THE FLEET LEADER ASI FUEL FILTER HAS BEEN SUBJECTED TO MICROSCOPE AND PENETRANT INSPECTION ON TWO OCCASIONS WITHOUT DETECTING ANY ANOMOLIES (9).

(1) RS007004; (2) R0018225; (3) ICD 13M16000; (4) RSS-B571-10; (5) RAD107-010 (6) RL00532, CP320R0003B; (7) RSS-8548, CP320R0003B; (8) RSS-305-19; (9) MPR-B5-0302, MPR-B5-0859

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**SSME FME IL
INSPECTION AND TEST**

Component Group: Combustion Devices
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	FILTER		R0019225
	FILTER INTEGRITY	FILTER BRAZE JOINTS ARE VISUALLY INSPECTED TO VERIFY 100% ALLOY FILLETS.	
	ASI SYSTEM CLEANLINESS	ASI SUBASSEMBLIES ARE CLEANED DURING MANUFACTURING AND PRIOR TO FINAL ASSEMBLY.	RL10001 RA0110-018
		AFTER BRAZING, THE PASSAGE PORTS AND ORIFICES ARE INSPECTED FOR BLOCKAGE DUE TO BRAZING MATERIAL.	RA1507-017 RA1507-018
		THE FUEL ASI SYSTEM IS PURGED DURING PROPELLANT CONDITIONING TO MAINTAIN IT FREE OF MOISTURE AND ICE FORMATION.	OMRSD 500FB0 310 OMRSD 500FB0 320
	PROPELLANT SYSTEM CLEANLINESS	SSME PROPELLANT SYSTEM IS DRIED AND VERIFIED DRY PRIOR TO EACH FLIGHT.	OMRSD V41C80 082 OMRSD V41C80 093
	ASSEMBLY INTEGRITY	THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY ASI INTEGRITY.	RL00050-04 RL00056-06 RL00056-07
		INSPECTION OF INJECTOR ASI CHAMBER AFTER EACH FLIGHT VERIFIES NO BLOCKAGE HAS OCCURRED DURING PREVIOUS OPERATION (LAST TEST).	OMRSD V41BJ0 010

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Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)

Reference: NASA letter SA21/8&308 and Rocketdyne letter 86RC09761.

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			

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

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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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