

**SSME FMEA/CIL
REDUNDANCY SCREEN**

Component Group: Combustion Devices
 CIL Item: A600-01
 Part Number: RS000020
 Component: Fuel Preburner
 FMEA Item: A600
 Failure Mode: ASI fails to ignite.

Prepared: A. Kay
 Approved: T. Nguyen
 Approval Date: 9/9/99
 Change #: 1
 Directive #: CCBD MEJ-01-5239

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Phase	Failure / Effect Description	Criticality Hazard Reference
S 4.1	<p>The preburner gases do not ignite, causing fuel pump speed to be below redline values. Mission scrub. Loss of vehicle due to LOX-rich operation may result if failure to establish fuel preburner ignition is not detected.</p> <p>Redundancy Screens: FUEL PREBURNER SYSTEM - SENSOR SYSTEM: UNLIKE REDUNDANCY</p> <p>A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround. B: Pass - Loss of a redundant hardware items is detectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.</p>	IR ME-R2S

**SSME / A/CIL
DESIGN**

Component Group: Combustion Devices
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Design / Document Reference

FAILURE CAUSE: A: Contamination which blocks fuel orifices or passages.

THE FUEL IS FILTERED TO 400-MICRONS AT THE EXTERNAL TANK (1). THE FUEL ASI DELIVERY SYSTEM IS DESIGNED TO REMOVE ANY PARTICLES THAT MAY CAUSE CUTOFF OR PARTIAL BLOCKAGE OF THE PASSAGES. A FILTER LOCATED AT THE HEAD OF THE DELIVERY SYSTEM REMOVES PARTICLES FROM THE FUEL THAT MAY BE LARGE ENOUGH TO CAUSE A REDUCTION IN FUEL FLOW (2). THE FILTER IS DESIGNED TO STOP PARTICLES IN THE FUEL AND ALLOW THEM TO SETTLE OFF THE FILTER FACE (3). 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. PRE-START HELIUM PURGE MINIMIZES POSSIBILITY OF ICE BLOCKAGE OF ASI. THE ASI FUEL FILTER IS FABRICATED FROM INCONEL 625 ALLOY, WHICH WAS SELECTED BECAUSE OF ITS BRAZEABILITY, WELDABILITY, MACHINABILITY, AND MATERIAL PROPERTIES (4). INCONEL 625 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 SYSTEM HAS BEEN DESIGN VERIFICATION TESTED FOR LOW PRESSURE IGNITION AND LOW MIXTURE RATIOS. THE FLEET LEADER ASI FUEL FILTER HAS BEEN REMOVED FOR MICROSCOPIC AND PENETRANT INSPECTION ON TWO OCCASIONS WITHOUT DETECTING ANY ANOMALIES (7)

(1) ICD 13M15000; (2) RS007004; (3) R0018225; (4) RSS-8572-0; (5) RA0107-010; (6) RL00532 CP320R0003B; (7) I.L. MPR-85-0869

FAILURE CAUSE: B: Contamination which blocks oxidizer orifices or passages.

THE OXIDIZER SUPPLY IS FILTERED TO 800-MICRONS AT THE EXTERNAL TANK (1). THE OXIDIZER ASI DELIVERY SYSTEM IS DESIGNED TO REMOVE ANY PARTICLES THAT MAY CAUSE CUTOFF OR PARTIAL BLOCKAGE OF THE PASSAGES. THE ASI SYSTEM HAS BEEN DESIGN VERIFICATION TESTED FOR LOW PRESSURE IGNITION AND LOW MIXTURE RATIOS

(1) ICD 13M15000

FAILURE CAUSE: ALL CAUSES

THE ASI CAN OPERATE OVER A WIDE MIXTURE RATIO RANGE AND PARTIAL BLOCKAGE CAN STILL ALLOW TIMELY IGNITION OF THE PROPELLANTS (1).

(1) RSS-305 19

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**SSME FMEA/CIL
INSPECTION AND TEST**

Component Group: Combustion Devices
 CIL Item: A600-01
 Part Number: RS009020
 Component: Fuel Preburner
 FMEA Item: A600
 Failure Mode: ASI fails to ignite.

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Failure Causes A, B	Significant Characteristics FILTER	Inspection(s) / Test(s)	Document Reference R0019226
	FUEL FILTER INTEGRITY	THE FILTER BRAZE JOINTS ARE INSPECTED TO VERIFY COMPLETE COVERAGE.	
	ASI SYSTEM CLEANLINESS	ASI SUBASSEMBLIES ARE CLEANED DURING MANUFACTURING AND PRIOR TO FINAL ASSEMBLY.	RL10001 RA1610-005
		AFTER BRAZING, THE PASSAGE PORTS AND ORIFICES ARE INSPECTED FOR BLOCKAGE DUE TO BRAZING MATERIAL	RA1607-009
		DURING PROPELLANT CONDITIONING THE FUEL ASI SYSTEM IS PURGED TO MAINTAIN IT FREE OF MOISTURE AND ICE	OMRSD S00FB0 310 OMRSD S00FB0 320
		ASI SUBASSEMBLIES AND THE MDV ARE CLEANED DURING MANUFACTURING TO OXYGEN SERVICE REQUIREMENTS	RL10001
		AFTER BRAZING, THE PASSAGE PORTS AND ORIFICES ARE INSPECTED FOR BLOCKAGE DUE TO BRAZING MATERIAL	RA1607-009
		DURING THE PROPELLANT CONDITIONING, THE OXIDIZER ASI SYSTEM IS PURGED TO MAINTAIN IT FREE OF MOISTURE AND ICE.	OMRSD S00FB0 300
	PROPELLANT SYSTEM CLEANLINESS	SSME PROPELLANT SYSTEM IS DRIED AND VERIFIED DRY PRIOR TO EACH FLIGHT.	OMRSD V41CR0 060 OMRSD V41CR0 061
ALL CAUSES	ASSEMBLY INTEGRITY	THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY CORRECT OPERATION.	RL00050-04 RL00055-03 RL00058-07
		ASI CHAMBERS ARE INSPECTED FOR DAMAGE PRIOR TO EACH LAUNCH. (LAST TEST)	OMRSD V41BU0 040

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Component: Combustion Devices
CIL Item: A600-01
Part Number: RS099020
Component: Fuel Preburner
FMEA Item: A600
Failure Mode: ASI fails to ignite.

Prepared: A. Day
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Approval Date: 9/9/99
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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 SA21/88/308 and Rockwell letter 88R005761.		
Operational Use:	Not Applicable.		

**SSME F A/CIL
WELD JOINTS**

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

Prepared: A. Kay
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Component	Basic Part Number	Weld Number	Weld Type	Class	Access	Critical Initial Flaw Size Not		Comments
						Root Side Not	Detectable	
FPB CHAMBER	RS009019	1,2	GTAW	I	X	X	X	
FPB INJECTOR	RS009020	1	EBW	II	X	X	X	
FPB INJECTOR	RS009020	2	EBW	II	X			
FPB INJECTOR	RS009020	3	GTAW	I	X	X	X	
FPB INJECTOR	RS009020	9	EBW	II	X			
FPB INJECTOR	RS009020	38	EBW	II	X			
FPB INJECTOR	RS009020	39	EBW	II	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
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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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