

**SSME / A/CIL
REDUNDANCY SCREEN**

Component Group: Combustion Devices
 CIL Item: A705-02
 Part Number: R0017440
 Component: Oxidizer Preburner (Phase II*)
 FMEA Item: A705
 Failure Mode: Loss of fuel to ASI.

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

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Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Loss of fuel to ASI causes high mixture ratio erosion of the ASI combustion chamber walls, injector burnout, loss of turbine, and engine failure. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A	MF-FB6S, MF-FB6M, MF-FB6A D

**SSME FMEA/CIL
DESIGN**

Component Group: Combustion Devices
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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 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 BRAZABILITY, 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 MEETS 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 ON THE PHASE II POWERHEAD SHOWED THE FLOW WASHES THE FILTER. THE FLEET LEADER ASI FUEL FILTER HAS BEEN SUBJECTED TO MICROSCOPIC AND PENETRANT INSPECTION ON TWO OCCASIONS WITHOUT DETECTING ANY ANOMALIES (9).

(1) RSD07034; (2) R0018225; (3) ICD 13M15001; (4) RSS-8571-70; (5) RAC107-010; (6) RL02532, CP320R0003B; (7) RSS-8546, CP320R0003B; (8) RSS-335-19; (9) MFR-85-0339 MFR-85-0859

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**SSME FMI / IIL
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.	RL100C1 RA0110-019
		AFTER BRAZING, THE PASSAGE PORTS AND ORIFICES ARE INSPECTED FOR BLOCKAGE DUE TO BRAZING MATERIAL.	RA1607-017 RA1607-019
		THE FUEL ASI SYSTEM IS PURGED DURING THE PROPELLANT CONDITIONING TO MAINTAIN IT FREE OF MOISTURE AND ICE FORMATION.	OMRSD S00F B0.310 OMRSD S00FB0.320
	PROPELLANT SYSTEM CLEANLINESS	SSME PROPELLANT SYSTEM IS DRIED AND VERIFIED DRY PRIOR TO EACH FLIGHT.	OMRSD V41CB0.082 OMRSD V41CB0.083
	ASSEMBLY INTEGRITY	THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY ASI INTEGRITY.	RL00050-04 RI 00055-06 RL00056-07
		INSPECTION OF THE INJECTOR ASI CHAMBER AFTER EACH FLIGHT VERIFIES NO BLOCKAGE HAS OCCURRED DURING PREVIOUS OPERATION (LAST TEST).	OMRSD V41BUC.040

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Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA).
 Reference: NASA letter SA2178B/JCS and Rocketdyne letter 89RC09761.
 Operational Use: Not Applicable.

**SSME FA/CIL
WELD JOINTS**

Component Group: Combustion Devices
 CIL Item: A706
 Component: R0017440
 Part Number: Oxidizer Preburner (Phase II*)
 A706

Prepared: A. Kay
 Approved: T. Nguyen
 Approval Date: 6/9/99
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Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical initial Flaw Size Not Detectable		Comments
						HCF	LCF	
OPB FUEL CHAMBER	R0017425	1	GTAW	I,II	X	X	X	
OPB FUEL CHAMBER	R0017425	2	GTAW	II	X	X	X	
OPB INJECTOR	R0017440	1	FRW	Ib	X	X	X	
OPB INJECTOR	R0017440	2	EBW	II	X	X	X	
OPB INJECTOR	R0017440	3	GTAW	II	X	X	X	
OPB INJECTOR	R0017440	9	EBW	II	X	N/A	N/A	
OPB INJECTOR	R0017440	28	EBW	II	X	N/A	N/A	
OPB INJECTOR	R0017440	29	EBW	II	X	X	X	
OPB INJECTOR	R0017440	31	GTAW	II	X			
OPB BODY	R0018067	1	GTAW	II	X	X	X	
OPB BODY	R0018067	2	EBW	I	X			
OPB BODY	R0018067	6	GTAW	II	X			
OPB BODY	R0018067	7	GTAW	II	X			
OPB FUEL MANIFOLD	RS009013	9(OPT), 10(OPT)	GTAW	I		X	X	
OPB FUEL MANIFOLD	RS009013	11(OPT)	GTAW	I		X	X	
OPB FUEL MANIFOLD	RS009013	13(OPT)	GTAW	I	X			
OPB OXID INLET	RS009014	6-8	GTAW	I		X		
OPB ASI FUEL LINE	RS009024	1	GTAW	I	X	X	X	

SSME FMEA/CIL

FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

Component Group: Combustion Devices
Item Name: Oxidizer Preburner (Phase II+)
Item Number: A705
Part Number: R0017449

Prepared: A. Kay
Approved: T. Nguyen
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Base Line Rationale	Variance	Change Rationale	Variation Dash Number
1. A705-09, -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.	R0018001-691, -701, 731, 991, -1051.

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