

SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group: Combustion Devices
CIL Item: A205-02
Part Number: RS009122
Component: Baffleless Main Injector (Phase I+)
FMEA Item: A205
Failure Mode: Loss of fuel to ASI.

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

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Phase	Failure / Effect: Description	Criticality
SMC 4 1	Partial or complete loss of fuel to ASI causes high mixture ratio erosion of the ASI combustor chamber walls, manifold invasion, injector burnout and LOX-rich operation. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A	Hazard Reference 1 ME-FB4S ME-FB4M, ME-FB4A,C

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SSME / AVCIL
DESIGN

Component Group: Combustion Devices
CIL Item: A205-02
Part Number: R5009122
Component: Baffleless Main Injector (Phase II+)
FMEA Item: A205
Failure Mode: Loss of fuel to ASI.

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Design / Document Reference

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

THE FUEL IS FILTERED TO 400-MICRONS AT THE EXTERNAL TANK INTERFACE (1). 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 AND 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 BEFORE CAUSING A DECREASE IN FUEL DELIVERY TO THE ASI CHAMBER. A PRE-START HELIUM PURGE MINIMIZES THE POSSIBILITY OF ASI ICE BLOCKAGE. THE ASI FUEL FILTER IS FABRICATED FROM INCONEL 625 ALLOY WHICH WAS SELECTED ON THE BASIS OF ITS BRAZABILITY, 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 A 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 FLEET LEADER ASI FUEL FILTER HAS BEEN REMOVED FOR MICROSCOPIC AND PENETRANT INSPECTION ON TWO OCCASIONS WITHOUT DETECTING ANY ANOMALIES (8). DESIGN TESTING OF THE FILTER WITH INDUCED CONTAMINATION SHOWED THE FLOW WASHES THE FILTER. THE ASI SYSTEM HAS BEEN DESIGN VERIFICATION TESTED FOR LOW PRESSURE IGNITION AND HIGH MIXTURE RATIOS (9).

(1) ICD 13M1500C; (2) RS007004; (3) RCD18225; (4) RSS-8572-10; (5) RAD107-010; (6) RLC0632 CP320R0002B; (7) RSS-8546, CP320R0003B; (8) MPR-85-0309, MPR 85 0819; (9) RSS-335-19

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**SSME FMEA/CIL
INSPECTION AND TEST**

Component Group: Combustion Devices
 CIL Item: A205-02
 Part Number: RS009122
 Component: Baffleless Main Injector (Phase II+)
 FMEA Item: A206
 Failure Mode: Loss of fuel to ASI.

Prepared: A. Kay
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 Directive #: CCB0 ME3 01 5218

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	FILTER		R001B225
	FILTER INTEGRITY	FILTER BRAZE JOINTS ARE INSPECTED TO VERIFY COMPLETE BRAZE FLOW AT SCREEN INTERSECTIONS PER DRAWING AND SPECIFICATION REQUIREMENTS.	R001B225 RA0107-010
	ASI SYSTEM CLEANLINESS	ASI SUBASSEMBLIES ARE CLEANED DURING MANUFACTURING AND PRIOR TO FINAL ASSEMBLY.	RL100C1 RA1510-005
		AFTER BRAZING, THE PASSAGE PORTS AND ORIFICES ARE INSPECTED FOR BLOCKAGE DUE TO BRAZING MATERIAL	RA1507-009
		DURING PROPELLANT CONDITIONING THE FUEL ASI SYSTEM IS PURGED TO MAINTAIN IT FREE OF MOISTURE AND ICE	OMRSD S00F80.310 OMRSD S00F80.320
	PROPELLANT SYSTEM CLEANLINESS	SSME PROPELLANT SYSTEM IS DRIED AND VERIFIED DRY PRIOR TO EACH FLIGHT.	OMRSD V41CB0.082 OMRSD V41CB0.083
		DURING PROPELLANT CONDITIONING THE SSME PROPELLANT SYSTEM IS PURGED TO MAINTAIN IT FREE OF MOISTURE AND ICE	OMRSD S00F80.330
	ASSEMBLY INTEGRITY	HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY FILTER INTEGRITY	RL00350-04 RL00356-05 RL00356-07
		THE ASI IS INSPECTED FOR CONTAMINATION AND DAMAGE PRIOR TO EACH LAUNCH (LAST TEST).	OMRSD V41BJ0 029

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Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
 Reference: NASA letter SA21788-308 and Rocketdyne letter 88RC09781.

Operations Use: Not Applicable.

**SSME I A/CIL
WELD JOINTS**

Component Group: Combustion Devices
 CIL Item: A205
 Component: RS009122
 Part Number: Baffleless Main Injector (Phase II+)
 A205

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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	
MAIN INJECTOR ASI LINE	RS009061	3	GTAW	I		X	X	
MAIN INJECTOR ASI LINE	RS009061	5	GTAW	I		X	X	
MAIN INJECTOR	RS009126	1	EBW	I				
MAIN INJECTOR	RS009126	6-7,52-53	GTAW	I	X	X	X	
MAIN INJECTOR	RS009126	9	EBW	I				
MAIN INJECTOR	RS009126	3	CBW	I	X			
MAIN INJECTOR	RS009126	10	EBW	II	X	X	X	
MAIN INJECTOR	RS009126	12-13	GTAW	I	X			
MAIN INJECTOR BODY	RS009126	14-15	GTAW	I	X	X	X	
MAIN INJECTOR BODY	RS009126	16	GTAW	I	X	X	X	
MAIN INJECTOR BODY	RS009126	17	GTAW	I	X	X	X	
MAIN INJECTOR	RS009126	20	GTAW	I	X			
MAIN INJECTOR	RS009126	21	GTAW	I	X			
MAIN INJECTOR	RS009126	22	GTAW	I	X			
MAIN INJECTOR	RS009126	23-29,54	GTAW	I	X			
MAIN INJECTOR	RS009126	44-45	EBW	I	X	X	X	
MAIN INJECTOR	RS009126	50-51	CBW	Ia	X	X	X	
MAIN INJECTOR	RS009126	59	EBW	I,II	X			
MAIN INJECTOR	RS009126	60-61	GTAW	II	X			
MAIN INJECTOR BODY	RS009237	600 FLCS	FRW	I		X	X	
MAIN INJECTOR LOX SUPPLY LINE	RC018C15	1	GTAW	I	X	X		

SSWIE FIVEA/CIL

FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

Component Group: Combustion Devices
 Item Name: Baffleless Main Injector (Phase II+)
 Item Number: A205
 Part Number: RS009122

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Base Line Rationale	Variance	Change Rationale	Variant Case Number
1. NO RATIONALE EFFECTED	REWORKED BAFFLE POSTS EXIST ON 2 DASH NUMBERS.	INLINE REWORK OF COMPLETED BAFFLE MAIN INJECTOR IS AN ALLOWABLE ALTERNATE TO THE BAFFLELESS MAIN INJECTOR	RS009122-1571, RS009122-1581
2. NO RATIONALE EFFECTED.	BLOCK I Isp IMPROVEMENTS DO NOT EXIST ON 2 POWERHEADS	BLOCK I FLIGHT ENGINES MEET CEI REQUIREMENTS FOR Isp. HOWEVER, CERTAIN FLIGHT MANIFESTS REQUIRE AN INCREASE IN Isp FROM THE BLOCK I FLIGHT ENGINES. THE MAIN INJECTOR PRIMARY AND SECONDARY FACEPLATES WERE MODIFIED TO ENHANCE THE COMBUSTION PROCESS.	RS009122-1671
3. A205-12 AND A205-13, BLOCK III Isp IMPROVEMENTS.	THE BLOCK I FLIGHT ENGINES DO NOT HAVE THE MODIFIED MAIN INJECTOR PRIMARY AND SECONDARY FACEPLATES, ROW 13, FUEL SLEEVES AND NEW V-SEAL	BLOCK I FLIGHT ENGINES MEET CEI REQUIREMENTS FOR Isp	RS009122-1681

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