SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group:	Combustion Devices	Prepared:	A. Kay
CIL Item:	A600-04	Approved:	T. Nguyen
Part Number	RS009020	Approval Date:	9/9/99
Component:	Fuel Preburner	Change #:	1
FMEA Item:	A600	Directive #:	CCBD ME3-01-5238
Failure Mode:	Non-uniformity of fuel flow in the injection element occurs.	Page:	1 of 1

Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Significant non uniformity causes local high mixtures and recirculation of gases around the elements periphery which cause local erosion of the injection element tip, the injector faceplate, the combustion zone liner or the injector baffle. Erosion through the liner may result in burnthrough of the structural wall. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-B2S, ME-B2A,C, ME-B2M

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Design / Document Reference

FAILURE CAUSE: A: Contamination in the fuel annulus.

THE FUEL IS FILTERED TO 400-MICRONS AT THE EXTERNAL TANK (1). THE PREBURNER INJECTION ELEMENT (2) CONSISTS OF A FUEL SLEEVE ENCIRCLING A LOX POST WITH THE TWO BRAZED TOGETHER. THE GAP BETWEEN THE LOX POST AND THE FUEL SLEEVE IS CONTROLLED (2) (3). THE FUEL PASSAGE IS FED BY A SERIES OF SMALL HOLES EQUALLY SPACED AROUND THE EXTERNAL SLEEVE IN STAGGERED ROWS. THE HOLES ARE SMALLER IN DIAMETER THAN THE ANNULUS DIMENSIONS. THIS SYSTEMS ACTS A FILTER FOR THE ANNULUS. THE PREBURNER INJECTOR ELEMENT HAS BEEN DESIGN VERIFICATION TESTED FOR ELEMENT CONTAMINATION (2). INSPECTIONS OF THE PREBURNERS IN ENG NE 2010 REVEALED NO CONTAMINATION IN THE FUEL ANNULUS (5). A REVIEW OF THE PREBURNER UCR DATA SHOWED LOW OCCURRENCE RATE OF CONTAMINATED PASSAGES. 12 OF 42 CAUSED EROSION/SELF-CONTAINED DAMAGED.

(1) ICD 13M15000; (2) RS009025; (3) RS009020; (4) RSS-305-5; (5) MPR-86-0137

FAILURE CAUSE: B: Slippage of LOX post support pins.

THE FUEL PREBURNER INJECTOR ELEMENT SUPPORT IS FABRICATED FROM 304 CRES NEEDLE TUBING (1). THE TUBE DESIGN GIVES THE PINS A SPRING CHARACTERISTIC. THREE PINS ARE INSTALLED IN THE FUEL ANNULUS OF THE FUEL PREBURNER INJECTION ELEMENT (2) EQUALLY SPACED 120 DEGREES APART FROM EACH OTHER, TO DAMPEN VIBRATION CAUSED BY MECHANICAL MOVEMENT AND FLOW. THE PINS ARE HELD IN PLACE BY FRICTION. HIGH CYCLE FATIGUE AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (3). THE MINIMUM FACTORS OF SAFETY MEET CEI REQUIREMENTS (4). RANDOM LOSS OF PINS OCCURS DURING HOT FIRE TESTING. TEST HISTORY HAS SHOWN PIN SLIPPAGE OR LOSS IS NOT DETRIMENTAL TO PREBURNER OPERATION

(1) R0015757; (2) RS009020; (3) RL00532, CP320R0003B; (4) RSS-8546, CP320R0003B

SSME FMEA/CIL
INSPECTION AND TEST

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Part Number:	RS008020	Approval Date:	9/9/99
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	PREBURNER INJECTOR ELEMENT		RS009025
	CLEANLINESS	POSTS ARE CLEANED PER SPECIFICATION REQUIREMENTS.	RA2110-018
		AFTER BRAZING THE POST ARE INSPECTED FOR BLOCKAGE.	RA1307-004 RA1307-007
		SSME PROPELLANT SYSTEMS ARE DRIED AND VERIFIED DRY PRIOR TO EACH FLIGHT	OMRSD V41CS0.080 OMRSD V41CS0.081
		UPSTREAM COMPONENTS ARE VERIFIED CLEAN TO FUEL SERVICE PER SPECIFICATION REQUIREMENTS.	RL10001
	ASSEMBLY INTEGRITY	THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY PREBURNER INJECTORS INTEGRITY.	RL00050-04 RL00050-05 RL00050-07
B	SUPPORT PIN		R0016767
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	
		HEAT TREAT IS VERIFIED PER DRAWING REQUIREMENTS.	
	PIN INSTALLATION	VERIFIED INTERFERENCE FIT OF PIN INSTALLATION PER DRAWING REQUIREMENTS.	RS009020
	ASSEMBLY INTEGRITY	ASSEMBLY IS VERIFIED CLEAN PER SPECIFICATION REQUIREMENTS.	RL10001
		SUPPORT PINS ARE INSPECTED EACH TIME HPFTP IS REMOVED OR PER TIME CYCLE REQUIREMENTS.	OMRSD V41BU0.081C OMRSD CC0BA0.015
		THE PREBURNER IS BORESCOPE INSPECTED PRIOR TO EACH FLIGHT FOR DAMAGE. (LAST TEST)	OMRSD V41BU0.040

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
Reference: NASA letter SA21:88/308 and Rocketdyne letter 88RC0976

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
Approved: T. Nguyen
Approval Date: 9/9/99
Change #: 1
Directive #: CCBD ME1-01-5238

Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable HCF	LCF		Comments
FPB CHAMBER	RS009019	1,2	GTAW	I	X	X	X		
FPB INJECTOR	RS009020	1	EBW	Ib	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 ASI FUEL LINE	RS009525	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
Approved: T. Nguyen
Approval Date: 9/9/99
Change #: 1
Directive #: CCBD ME3-01-5235

Base Line Rationale	Variance	Change Rationale	Variant Dash Number
1. A603- NO RATIONALE EFFECTED.	MOLY 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