

**SSME / A/CIL  
REDUNDANCY SCREEN**

Component Group: Combustion Devices  
 CIL Item: A330-05  
 Part Number: RSC09105  
 Component: Main Combustion Chamber  
 FMEA Item: A330  
 Failure Mode: Lee Jet fails to meter flow.

Prepared: A. El Ahmad  
 Approved: T. Nguyen  
 Approval Date: 9/9/99  
 Change #: 1  
 Directive #: CCBDMES-01-5239

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Phase	Failure / Effect Description	Criticality Hazard Reference
M 4.1	<p>Loss of the purge allows icing over a long period of time causing an indicated Pc increase, resulting in channel disqualification. Disqualification of both channels results in electrical lockup. Loss of mission may result when electrical lockup occurs during Max Q throttling. Loss of mission could also occur as a result of an engine shutdown after Max Q if the Pc Drift Discriminator is lost.</p> <p>Redundancy Screens: SENSOR SYSTEM: LIKE 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>	1R ME-G#1

SSME FMEA/CIL  
DESIGN

Component Group: Combustion Devices  
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Part Number: RS009105  
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FMEA Item: A330  
Failure Mode: Lee Jet fails to meter flow.

Prepared: A. El-Ahmad  
Approved: T. Nguyen  
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Design / Document Reference

FAILURE CAUSE: A: Lee Jet becomes plugged due to contamination.

THE PRESSURE SENSOR SYSTEM IS A REDUNDANT SYSTEM COMPRISED OF REDUNDANT SENSORS, REDUNDANT HARNESSSES, AND REDUNDANT CONTROLLER CHANNELS (1). TWO SEPARATE LEE JETS ARE LOCATED ON THE MCC, 90 DEGREES APART. THE LEE JET ORIFICE IS SURROUNDED BY AN INSERT WHICH PROVIDES PHYSICAL PROTECTION FOR THE ORIFICE DURING FABRICATION AND INSPECTION (2). THE SCREEN IS CONE SHAPED, GIVING IT A LARGE SURFACE AREA (3), REDUCING THE POSSIBILITIES OF BLOCKAGE DUE TO CONTAMINATION. THE PRE-START PURGE MINIMIZES THE POSSIBILITIES OF ICE FORMATION. A CLOGGED LEE JET IS INDICATED BY A DIFFERENCE IN THE TWO SENSORS. THE LEE JET ORIFICE INSERT PROJECTS INTO THE OUTLET MANIFOLD FLOW STREAM TO PREVENT DEBRIS FROM SETTLING ONTO THE SCREEN. THE FUEL IS FILTERED TO 400-MICRONS AT THE EXTERNAL TANK (4). THE LEE JET ASSEMBLY IS PRESS-FIT INTO THE MCC BASE RING (5) AND SECURED WITH AN EXPANDER PIN (6). THE LEE JET BODY AND EXPANDER PIN ARE FABRICATED FROM 303 CRES WHICH EXHIBITS GOOD CORROSION RESISTANCE AND STRENGTH IN A CRYOGENIC ENVIRONMENT. THE LEE JET ASSEMBLY IS SUBJECT TO A PROOF LOAD TEST TO VERIFY PROPER INSTALLATION (7). THE LEE JET CAVITY IS CONTAINED (ON THE PRESSURE TRANSDUCER SIDE) BY THE TRANSDUCER OFFSET MOUNT POST (8) WHICH, IN THE EVENT OF DISLODGING IS DESIGNED TO RESTRICT PURGE ORIFICE (LEE JET) MOVEMENT.

(1) CP406R0008 3.2.2-4 (2) RS009232; (3) RE251-4301-5202; (4) ICD 13M15000; (5) RS009111; (6) RE251-4301-5202, (7) RSC07C32; (8) R0010760-025

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**SSME FME IIL  
INSPECTION AND TEST**

Component Group: **Combustion Devices**  
 CIL Item: **A330-05**  
 Part Number: **RS009105**  
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 FMEA Item: **A330**  
 Failure Mode: **Lee Jet fails to meter flow.**

Prepared: **A. El-Ahmad**  
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 Approval Date: **9/9/99**  
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 Directive #: **CCBD ME3-01-5238**

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	LEE JET		RC251 4301 5202
	FUEL CLEANLINESS	LEE JET AND UPSTREAM COMPONENTS ARE CLEANED TO FUEL USAGE REQUIREMENTS.	RL10001
	ASSEMBLY INTEGRITY	THE HOT FIRE TESTING VERIFY SATISFACTORY OPERATION PROPELLANT SYSTEM IS DRIED AND VERIFIED DRY AFTER EACH FLIGHT. SYSTEM PURGE PRIOR TO LAUNCH ASSURES PASSAGES ARE FREE OF MOISTURE. (LAST TEST)	RL00050-04 OMRSD W41CR0.081 OMRSD W41CR0.060 OMRSD S00FB0.300

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)  
 Reference: NASA letter SA21/BB/308 and Rocketdyne letter BBRC09761.

Operational Use: FAILURE MODE CAN BE DETECTED IN REALTIME BY THE FLIGHT CONTROL TEAM WHO WILL EVALUATE EFFECTS UPON VEHICLE PERFORMANCE AND ABORT CAPABILITY. BASED ON THIS EVALUATION THE APPROPRIATE ABORT MODE OR SYSTEM CONFIGURATION WILL BE SELECTED. FAILURE DETECTION CUES AND ASSOCIATED SSME PERFORMANCE DATA HAVE BEEN COORDINATED BETWEEN THE ENGINEERING AND FLIGHT OPERATIONS ORGANIZATIONS WITH THE RESPONSES DOCUMENTED IN MISSION FLIGHT RULES.

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**SSME / A/CIL  
WELD JOINTS**

Component Group: Combustion Devices  
 CIL Item: A330  
 Component: RS009105  
 Part Number: Main Combustion Chamber  
 A330

Prepared: A. El-Ahmad  
 Approved: T. Nguyen  
 Approval Date: 9/9/99  
 Change #: 1  
 Directive #: CCBD MC3 01-5239  
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Component	Basic Part Number	Weld Number	Weld Type	Class	Critical Initial		Comments
					Root Size Not Access	Flaw Size Not Detectable	
					HCF	LCF	
MAIN COMBUSTION CHAMBER	RS009105	5	EBW	Ia	X	X	
MAIN COMBUSTION CHAMBER	RS009105	6,7	EBW	Ib	X	X	
MAIN COMBUSTION CHAMBER	RS009105	58,59	EBW	Ia	X	X	
MAIN COMBUSTION CHAMBER	RS009105	10	GTAW	I	X	X	X
MAIN COMBUSTION CHAMBER	RS009105	11,12,13,14	GTAW	II	X	X	X
MAIN COMBUSTION CHAMBER	RS009105	15	GTAW	II	X	X	
MAIN COMBUSTION CHAMBER	RS009105	16	ESW	Ia	X	X	X
MAIN COMBUSTION CHAMBER	RS009105	18	ESW	I	X		
MAIN COMBUSTION CHAMBER	RS009105	22	PAW	II	X		
MAIN COMBUSTION CHAMBER	RS009105	23	PAW	II	X		
MAIN COMBUSTION CHAMBER	RS009105	24,26	EBW	I			
MAIN COMBUSTION CHAMBER	RS009105	25	EBW	I			
MAIN COMBUSTION CHAMBER	RS009105	39,40	EBW	I	X	X	
MAIN COMBUSTION CHAMBER	RS009105	41-44,69,70	GTAW	II	X		
MAIN COMBUSTION CHAMBER	RS009105	55,56	EBW	I	X		
MAIN COMBUSTION CHAMBER	RS009105	65	GTAW	II	X		
MAIN COMBUSTION CHAMBER	RS009105	68	GTAW	II	X	X	
LINER	RS009105	1	GTAW	II	X	X	X
MCC INLET MANIFOLD	RS009109	1,9,12	GTAW	I	X	X	
MCC INLET MANIFOLD	RS009109	2,3	GTAW	I	X	X	
MCC INLET MANIFOLD	RS009109	6-8	EBW	Ib	X		
MCC INLET MANIFOLD	RS009109	10	GTAW	I	X	X	
MCC INLET MANIFOLD	RS009109	11,13	GTAW	I		X	
MCC INLET MANIFOLD	RS009109	14	GTAW	I	X		
MCC INLET MANIFOLD	RS009109	15	GTAW	I	X	X	
MCC INLET MANIFOLD	RS009109	16	GTAW	I		X	
MCC INLET MANIFOLD	RS009109	17	GTAW	I			
MCC OUTLET MANIFOLD	RS009110	1	GTAW	I		X	X
MCC OUTLET MANIFOLD	RS009110	2	GTAW	I		X	X
MCC OUTLET MANIFOLD	RS009110	3,4	GTAW	I			
MCC OUTLET MANIFOLD	RS009110	5,6	GTAW	I	X	X	X

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Component Group: Combustion Devices  
 CIL Item: A330  
 Component: RS009105  
 Part Number: Main Combustion Chamber  
 A330

Approved: T. Nguyen  
 Approval Date: 5/5/99  
 Change #: 1  
 Directive #: CCB0 ME3-01-5238  
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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	
MCC OUTLET MANIFOLD	RS009110	9	GTAW	I	X	X		
MCC OUTLET MANIFOLD	RS009110	10	GTAW	I	X	X		
MCC OUTLET MANIFOLD	RS009110	22	GTAW	I				
MCC OUTLET MANIFOLD	RS009110	24-27	GTAW	I	X	X		
MCC OUTLET MANIFOLD	RS009110	30	GTAW	I				
MCC OUTLET ELBOW	RS009497	1,2	GTAW	I		X		
MCC OUTLET ELBOW	RS009497	10	GTAW	I				
MCC OUTLET ELBOW	RS009497	3	GTAW	I				
MCC OUTLET ELBOW	RS009497	11	GTAW	I				
MCC OUTLET ELBOW	RS009497	4	GTAW	I		X		
MCC OUTLET ELBOW	RS009497	5	GTAW	I				
MCC OUTLET ELBOW	RS009497	9,12	GTAW	I	X	X	X	
MCC OUTLET ELBOW	RS009497	8,13	GTAW	I	X	X	X	
MCC OUTLET ELBOW	RS018262	3	GTAW	I		X	X	COMPLETED WELD ASSESSMENT REQUIRED
MCC INLET NECK	RS009499	1,2	GTAW	I	X	X	X	
MCC INLET NECK	RS009499	3,4	GTAW	I		X	X	

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**SSME FMEA/CIL**  
**FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE**

Component Group: Combustion Devices  
 Item Name: Main Combustion Chamber  
 Item Number: A330  
 Part Number: RS009105

Prepared: A. ElAhmad  
 Approved: T. Nguyen  
 Approval Date: 9/8/99  
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 Directive #: CCBD ME3-01-5228

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Base Line Rationale	Variance	Change Rationale	Variant Dash Number
1. A330-04 OUTLET MANIFOLD PROOF PRESSURE TESTED TO 7875 PSIG (ECP 830)	OUTLET MANIFOLD PROOF TESTED TO 6600 PSIG.	HIGHER PRESSURE ENHANCED CONFIDENCE IN PROOF PRESSURE TEST EFFECTIVITY. USE AS IS RATIONALE ALL UNITS RE-PENETRANT INSPECTED AND RE-XRAYED USING SPECIAL HIGH SENSITIVITY TECHNIQUES.	-351, -371, 401, -431 -441 -451

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