

SSME -A/CIL
REDUNDANCY SCREEN

Component Group: Combustion Devices
CIL Item: A330-04
Part Number: RSD09105
Component: Main Combustion Chamber
FMEA Item: A330
Failure Mode: External rupture.

Prepared: A. El-Ahmad
Approved: T. Nguyen
Approval Date: 9/9/99
Change #: 1
Directive #: CCBD ME3-01-5210

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Phase
SMC
4.1

Failure / Effect Description
Leakage into the aft compartment will cause overpressurization. Loss of vehicle.
Redundancy Screens: SINGLE POINT FAILURE: N/A

Criticality
Hazard Reference
1
ME-B5S,
ME-B5M
ME-B5A,C

SSME FMEA/CIL DESIGN

Devices

Silon Chamber

ure.

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Approval Date: 9/9/99
Change #: 1
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Design / Document Reference

nt material failure.

OLD ASSEMBLIES ARE MANUFACTURED FROM INCONEL 718. HEAT TREATED AFTER ASSEMBLY. ITS STRENGTH AFTER HEAT TREAT IS THE
TION (1). THE OPERATING ENVIRONMENT FOR THE INLET MANIFOLD ASSEMBLY IS BELOW THE TEMPERATURE WHERE 718 BEGINS
RONMENT EMBRITTLEMENT (1). INCONEL 718 IS PROTECTED FROM HYDROGEN ON THE OUTLET MANIFOLD ASSEMBLY BY COPPER PLATING AND
THE COPPER PLATING IS CONTROLLED PER SPECIFICATION REQUIREMENTS TO ASSURE BONDING AND COVERAGE (3). THE OUTLET
RE BLENDED SMOOTH TO THE PARENT MATERIAL AND REINFORCED WITH NICKEL PLATING FOR STRENGTH (4). THE NICKEL PLATING PROCESS
). STRAIN GAUGE TESTING HAS BEEN PERFORMED TO VERIFY OPERATING ENVIRONMENT, AND ADDITIONAL INSPECTIONS WERE PERFORMED
NATIVE OUTLET MANIFOLD SPLITTER-ELBOW CONFIGURATION MACHINED FROM A SINGLE FORGING REPLACES THE WELDED SUBASSEMBLY
SHELL-TO-BASE RING WELDS ON BOTH MANIFOLDS ARE DESIGNED WITH TRANSITION RADIIUSFS TO REDUCE STRESS RISERS (6)(2). AN
IFOLD SPLITTER-ELBOW CONFIGURATION MACHINED FROM A SINGLE FORGING ELIMINATES THE WELDED SUBASSEMBLY (6). THE INLET
RINED FROM TUBING TO PRODUCE A CONSISTENT PART CONFIGURATION. TRANSITION RINGS AT THE INLET AND OUTLET ELBOW JOINTS AND
TH INCREASED MATERIAL THICKNESS (6)(2). THE STRUCTURAL JACKET IS DESIGNED TO RESTRAIN THE LINER FROM EXPANSION DUE TO
"STRUCTURE IS REINFORCED BY THE JACKET THROAT SHELL. THE STRUCTURAL JACKET AND SHELL ARE FABRICATED FROM INCONEL 718
OR TO ASSEMBLY. INCONEL 718 WAS SELECTED DUE TO ITS STRENGTH AFTER HEAT TREAT (7). ELECTRON BEAM WELDS ARE USED TO JOIN
LONGITUDINAL WELDS AND AT THE THROAT (7). THE ER. PROCESS IS CONTROLLED BY SPECIFICATION (8). THE WELD JOINT DESIGN IS
THE LONGITUDINAL JACKET WELDS ARE TIG OVERLAYED WITH ADDITIONAL INCONEL 718 TO INCREASE THE WELD THICKNESS (7). THE
A PLASMA ARC WELD ELIMINATING THE NEED FOR A BACKUP STRIP, THIS PROCESS IS CONTROLLED BY SPECIFICATION (10). THE INSIDE
INED PER NUMERICAL CONTROL TAPE FOR MINIMAL LINER EXPANSION DURING HOT FIRE (11). THE FORWARD END OF THE JACKET AT THE
EPTION UNITS ARE LIMITED BY MAJOR WAIVER (13). THE MAIN COMBUSTION CHAMBER PARENT MATERIALS WERE CLEARED FOR FRACTURE
ICE THEY ARE NOT FRACTURE CRITICAL PARTS EXCEPT FOR THE INLET AND OUTLET MANIFOLDS, AND STRUCTURAL JACKET WHICH WERE
1). THE FMEA/CIL WELDS ARE CLEARED FOR FRACTURE MECHANISMS/NOE FLAW GROWTH BY THE WELD ASSESSMENT (15). TABLE A330 LISTS
ES THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE AND THOSE WELDS IN WHICH THE ROOT SIDE IS NOT
258 WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE ARE ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (15). THE
SEEN DESIGN VERIFICATION TESTED FOR STRUCTURAL INTEGRITY (16). PRIMARY STRESS FACTORS OF SAFETY MEET CIL REQUIREMENTS
XEL REINFORCED OUTLET MANIFOLD AND ONE PIECE SPLITTER-TEE ELBOWS MEET CIL LIFE REQUIREMENTS (12).

641109-002 (4); RS009125; (5) RA1609-045; (6) RS009108; (7) RS009105; (8) RA-0607-094; (9) RS009112; (10) RL10311; (11) MC-MISC-41-560; (12);
51 (14) NASA TASK 117; (15) RSS-8756 (16) RSS-1C1-14; (17) RSS-8546, CP3ZDR0003B

SSME FM CIL
INSPECTION AND TEST

Devices

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Approval Date: 9/9/99
Change #: 1
Directive #: CCBD ME3-C1-5238

Station Chamber

Unit

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General Characteristics
MANIFOLD

Inspection(s) / Test(s)

Document Reference
RS009103
RS009119

MATERIAL INTEGRITY

MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS

RB0170-163
RB0170-154

ULTRASONIC INSPECTION OF DETAIL FORGINGS OR RADIOGRAPHIC INSPECTION OF MACHINED PARTS IS PERFORMED PER DRAWING AND SPECIFICATION REQUIREMENTS.

RA0115-012
RA0115-008

PENETRANT INSPECTION OF THE SUBASSEMBLIES AND WELDED ASSEMBLY IS PERFORMED PER SPECIFICATION REQUIREMENTS.

RA0115-116

HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.

RA0511-020

ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE.

RL10311
RA0607-094
RA0115-116
RA0115-006
RA0115-127
RA0115-001

ALL WELDS ARE PROOF PRESSURE TESTED AND PENETRANT INSPECTED AFTER PROOF.

RL00501
RL00520

PROOF PRESSURE TESTED OUTLET MANIFOLD WELDS ARE RE-X-RAYED AND PENETRANT INSPECTED.

RS009105
RA0115-115

PROOF PRESSURE TESTED LINER MANIFOLD AND WELDS ARE PENETRANT INSPECTED

RS009105

COPPER PLATING IS INSPECTED FOR COVERAGE AND ADHESION BAKED TO VERIFY BONDING.

RA1199-002

PLATING INTEGRITY

RA1939-045
RS009105

PLATING IS VERIFIED TO BE BLENDED SMOOTHLY TO PARENT MATERIAL. PENETRANT AND VISUALLY INSPECTED. THE WALL AND PLATING THICKNESSES ARE VERIFIED TO BE CORRECT. THE PLATED OUTLET IS PROOF LOADED TO ASSURE BOND LINE STRENGTH

RL00501
RL00520

A PROOF PRESSURE AND LEAK TEST IS PERFORMED ON BOTH INLET AND OUTLET MANIFOLDS AND COMPLETED ASSEMBLY.

RS009110
RS000109

MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.

RS009105
RS009112

MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.

RB0170-153

FORGINGS ARE PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.

RA0115-116

Devices

Position Chamber

JRE.

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Change #: 1
Directive #:

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9/9/99
1
CCBD NE3-01-5238

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Part Characteristics

Inspection(s) / Test(s)

Document Reference

HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.

RAC511-020

TEGRITY

ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS. INSPECTIONS INCLUDE: VISUAL DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE.

RL1001*

RAC507-084

RAC115-116

RAC115-006

RAC115-127

RA1115-001

LY INTEGRITY

THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY MCC INTEGRITY

RL00050-01

RL00056-05

RL00056-07

A SIGNATURE LEAK TEST IS PERFORMED. HELIUM IS PRESSURIZED IN THE HOT-GAS SYSTEM FOR LEAK DETECTION, PRIOR TO EACH LAUNCH. (LAST TEST)

OMRSD 500000.850

The history data is maintained in the Problem Reporting database (PRAMS/PRACA) after SAZ166/326 and Rocketdyne letter BRRC09701.

**SSME I 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	Root Size Not Access	Critical Initial Flaw Size Not Detectable		Comments
						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
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 Approval Date: 9/8/99
 Change #: 1
 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 7 875 PSIG (ECP 830)	OUTLET MANIFOLD PROOF TESTED TO 6 600 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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