

**SSME / FACIL
REDUNDANCY SCREEN**

Component Group: Combustion Devices
CIL Item: A700-12
Part Number: RS009004
Component: Oxidizer Preburner
FMEA Item: A700
Failure Mode: Omega Joint failure.

Prepared: A. Kay
Approved: T. Nguyen
Approval Date: 5/9/99
Change #: 1
Directive #: CCBD ME3 01-5238

Page: 1 of 1

Phase	Failure / Effect Description	Criticality
SMC 4.1	Loss of the joint causes oxidizer rich operation across the injector face and turbine failure. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A	Hazard Reference 1 ME-B65 MF B6A D. MF B6M

A - 299

SSME FMEA/CIL
DESIGN

Component Group: Combustion Devices
CIL Item: A700-12
Part Number: RS009004
Component: Oxidizer Preburner
FMEA Item: A700
Failure Mode: Omega joint failure.

Prepared: A. Kay
Approved: T. Nguyen
Approval Date: 8/9/99
Change #: 1
Directive #: CCBD ME3-01-5239

Page: 1 of 1

Design / Document Reference

FAILURE CAUSE: A: Weld or parent material failure.

INCONEL 625 WAS SELECTED FOR THE PREBURNER EXPANSION JOINT BECAUSE OF ITS WELDABILITY, MACHINABILITY, AND MATERIAL PROPERTIES (1). THE JOINT IS NOT SUSCEPTABLE TO HYDROGEN EMBRITTLEMENT DUE TO LOW STRAINS IN THE MATERIAL. THE EXPANSION JOINT CONSISTS OF AN INTERNAL AND EXTERNAL RING CONNECTED BY A METAL U-CHANNEL (2) WHICH ALLOWS THE DISTANCE BETWEEN THE TWO RINGS TO EXPAND AND CONTRACT WITH THE FACEPLATE RADIAL AND AXIAL MOVEMENT. THE EFFECT OF SMALL LEAKAGE AT THE EXPANSION JOINT IS NOT DETRIMENTAL, IN VIEW OF THE AMOUNT OF FUEL THAT IS PASSED THROUGH THE FACEPLATE AND BEHIND THE LINER (3). HIGH CYCLE FATIGUE, LOW CYCLE FATIGUE LIFE, AND THE MINIMUM FACTORS OF SAFETY MEET CEI REQUIREMENTS (4). THE EXPANSION JOINT PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (5). THE FMEA/CIL WELDS ARE CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH BY THE WELD ASSESSMENT (5). TABLE A700 LISTS ALL FMEA/CIL WELDS AND IDENTIFIES THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE AND THOSE WELDS IN WHICH THE ROOT SIDE IS NOT ACCESSIBLE FOR INSPECTION. THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE ARE ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (5). THE PREBURNER WAS DVS TESTED (7).

(1) RSS-8571-0, (2) RS009002, (3) RSC07051, (4) RL00522, CP323R0000B, RSS-8548, (5) NASA TASK #17, (6) RSS-8758, (7) DVS-305

A - 300

**SSME FM/ OIL
INSPECTION AND TEST**

Component Group: Combustion Devices
 CIL Item: A700-12
 Part Number: RSC09004
 Component: Oxidizer Preburner
 FMEA Item: A700
 Failure Mode: Omega joint failure

Prepared: A. Kay
 Approved: T. Nguyen
 Approval Date: 9/9/99
 Change #: 1
 Directive #: CCBD ME3-01-5338

Page: 1 of 1

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	EXPANSION JOINT		RSC09004
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS EXPANSION JOINT IS PENETRANT INSPECTED AFTER COMPLETION PER SPECIFICATION REQUIREMENTS.	RA0115-116
	WELD INTEGRITY	ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE. TEST SAMPLE WELDS ARE MADE TO VERIFY PROCESS CONTROLS AND WELD GEOMETRY PRIOR TO RSC07051 WELDS 13 AND 14	RI 10011 RA0607-094 RA0115-116 RA0115-006 RA0115-127 RA1115-001 RA0607-034
	ASSEMBLY INTEGRITY	THE HOT FIRE TESTING AND 2ND E & M INSPECTIONS VERIFY OMEGA JOINT INTEGRITY THE INJECTOR FACE IS INSPECTED PRIOR TO EACH LAUNCH. (LAST TEST)	RL00050-04 RL00056-06 RL00056-07 OMRSD V41BL0 040

A - 301

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (FRAMS/PRACA)
 Reference: NASA letter SA7188/309 and Rocketdyne letter 88RC09761.
 Operational Use: Not Applicable

**SSME FMEA/CIL
WELD JOINTS**

Component Group: Combustion Devices
 CIL Item: A700
 Component: RS009004
 Part Number: Oxidizer Preburner
 A700

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

A - 303

Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
OPB CHAMBER	RS009003	1,2	GTAW	I	X	X	X	(A050)
OPB CHAMBER	RS009003	1(60DEG)	GTAW	II	X	X	X	(A050)
OPB INJECTOR	RS009004	1	EBW	II	X	X	X	
OPB INJECTOR	RS009004	2	EBW	I	X			
OPB INJECTOR	RS009004	3	GTAW	I	X			
OPB INJECTOR	RS009004	9	EBW	II	X			
OPB INJECTOR	RS009004	28	FBW	II	X			
OPB INJECTOR	RS009004	29	EBW	II	X			
OPB BODY	RS009007	1	GTAW	II	X			(A050)
OPB BODY	RS009007	2	EBW	II	X			(A050)
OPB BODY	RS009007	3	EBW	I				(A050)
OPB BODY	RS009007	4 (OPT)	GTAW	I	X			(A050)
OPB BODY	RS009007	10,11	GTAW	I	X	X	X	(A050)
OPB BODY	RS009007	12	GTAW	I	X		X	(A050)
OPB BODY	RS009007	13	GTAW	I	X	X	X	(A050)
OPB BODY	RS009007	14	GTAW	I	X	X	X	(A050)
OPB BODY	R0018067	1	GTAW	II	X	X	X	
OPB BODY	R0018067	2	EBW	I	X			
OPB BODY	R0018067	6	GTAW	I	X			
OPB BODY	R0018067	7	GTAW	I	X			
OPB FUEL MANIFOLD	RS009013	9(OPT)10 (OPT)	GTAW	I		X	X	(A050)
OPB FUEL MANIFOLD	RS009013	11 (OPT)	GTAW	I		X	X	(A050)
OPB FUEL MANIFOLD	RS009013	13 (OPT)	GTAW	I	X			(A050)
OPB OXID INLET	RS009014	6-E	GTAW	I		X		
OPB LINER	RS009015	2-17	GTAW	II	X			(A050)
OPB ASI FUEL LINE	RS009024	1	GTAW	I	X	X	X	(A050)
OPB CHAMBER	RS009003	3 (OPT) 4 (OPT)	GTAW	I		X	X	(A050)
OPB CHAMBER	RS009003	5 (OPT)	GTAW	I		X	X	(A050)
OPB CHAMBER	RS009003	6 (OPT)	GTAW	I	X			