

SSME / FA/CIL
REDUNDANCY SCREEN

Item Group: Combustion Devices
Item: A705-12
Revision Number: R0017440
Component: Oxidizer Preburner (Phase II+)
Item: A705
Mode: Omega joint failure

Prepared: A. J.
Approved: T. P.
Approval Date: 9/9.
Change #: 1
Directive #: CC

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Phase
SMC
4.1

Failure / Effect Description

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

SSME FMEA/CIL
DESIGN

Item Group: Combustion Devices
Item: A705-12
Number: R0017440
Item: Oxidizer Preburner (Phase II+)
Item: A705
Mode: Omega joint failure.

Prepared: A.
Approved: T.
Approval Date: 3/85
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Design / Document Reference

RE CAUSE: A: Weld or parent material failure.

OXIDIZER PREBURNER EXPANSION OMEGA JOINT IS FABRICATED FROM INCONEL 625. INCONEL 625 WAS SELECTED ON THE BASIS OF ITS WELDABILITY, MECHANICAL PROPERTIES (1). THE JOINT IS NOT SUSCEPTABLE TO HYDROGEN EMBRITTLEMENT DUE TO LOW OPERATING STRAINS. THE EXPANSION JOINT CONNECTS THE INTERNAL AND EXTERNAL RING CONNECTED BY A U-CHANNEL (2). THIS DESIGN ALLOWS RELATIVE MOVEMENT BETWEEN THE RINGS DUE TO RADIAL AND AXIAL MOVEMENT OF THE INJECTOR FACEPLATE. THE EFFECT OF SMALL LEAKAGE AT THE EXPANSION JOINT IS NOT DETRIMENTAL IN VIEW OF THE AMOUNT OF FUEL THAT IS PASSED THROUGH THE OMEGA JOINT AND BEHIND THE LINER (3). HIGH CYCLE FATIGUE, LOW CYCLE FATIGUE LIFE, AND THE MINIMUM FACTORS OF SAFETY MEET CEI REQUIREMENTS. THE PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (5). THE FMEA/CIL WAS DEVELOPED FOR FRACTURE MECHANICS/INDE FLAW GROWTH BY THE WELD ASSESSMENT (6). TABLE A705 LISTS ALL FMEA/CIL WELDS AND IDENTIFIES THOSE WELDS FOR WHICH THE INITIAL FLAW SIZE IS NOT DETECTABLE AND THOSE WELDS IN WHICH THE ROOT SIDE IS NOT ACCESSIBLE FOR INSPECTION. THOSE WELDS IN WHICH THE INITIAL FLAW SIZE IS NOT DETECTABLE ARE ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (6). THE PHASE II+ OXIDIZER PREBURNER WAS DVR TESTED (7).

3-8571-10 (2) RS009032; (3) R0011582; (4) RL00532, CP32DR0003B, RSS-8646; (5) NASA TASK 117; (6) RSS-8750; (7) RSS-8879-1

SSME FM CIL
INSPECTION AND TEST

Element Group: Combustion Devices
 Item: A705-12
 Number: R0017440
 Element: Oxidizer Preburner (Phase II+)
 Item: A705
 Mode: Omega joint failure.

Prepared: A. J.
 Approved: T. J.
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 Directive #: CC

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Ref
	EXPANSION JOINT		R1
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS EXPANSION JOINT IS PENETRANT INSPECTED AFTER COMPLETION PER SPECIFICATION REQUIREMENTS.	R1
	WELD INTEGRITY	ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS INSPECTIONS INCLUDE. VISUAL, DIMENSIONAL, AS APPLICABLE. TEST SAMPLE WELDS ARE MADE FOR R0018020 WELDS 7 AND 8 TO VERIFY WELD PROCESS CONTROL AND GEOMETRY	R1 R1 R1
	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).	R1 R1 R1 O1

History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
 Reference: NASA letter SA21/88/308 and Rockwell letter 88RC03751.
 Additional Use: Not Applicable

**SSME FA/CIL
WELD JOINTS**

Element Group: Combustion Devices
 Item: A706
 Element: R0017440
 Number: Oxidizer Preburner (Phase II*)
 A706

Prepared: A.
 Approved: T.
 Approval Date: 8/9
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Element	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical initial Flaw Size Not Detectable		Comments
						HCF	LCF	
FUEL CHAMBER	R0017425	1	GTAW	I,II	X	X	X	
FUEL CHAMBER	R0017425	2	GTAW	III	X	X	X	
INJECTOR	R0017440	1	FRW	Ib	X	X	X	
INJECTOR	R0017440	2	EBW	II	X	X	X	
INJECTOR	R0017440	3	GTAW	II	X	X	X	
INJECTOR	R0017440	9	EBW	II	X	N/A	N/A	
INJECTOR	R0017440	28	EBW	II	X	N/A	N/A	
INJECTOR	R0017440	29	EBW	II	X	X	X	
INJECTOR	R0017440	31	GTAW	II	X			
ODY	R0018067	1	GTAW	II	X	X	X	
ODY	R0018067	2	EBW	I	X			
ODY	R0018067	6	GTAW	II	X			
ODY	R0018067	7	GTAW	II	X			
FUEL MANIFOLD	RS009013	9(OPT), 10(OPT)	GTAW	I		X	X	
FUEL MANIFOLD	RS009013	11(OPT)	GTAW	I		X	X	
FUEL MANIFOLD	RS009013	13(OPT)	GTAW	I	X			
Oxidizer INLET	RS009014	6-8	GTAW	I		X		
SH FUEL LINE	RS009024	1	GTAW	I	X	X	X	

SSME FMEA/CIL

FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

Component Group: Combustion Devices
Item: Oxidizer Preburner (Phase II+)
Number: A705
Revision: R0017443

Prepared: A.
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Change #: 2
Directive #: CC
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Base Line Rationale	Variance	Change Rationale	Value
05-09, -10 -11: RATIONALE EFFECTED.	POWERHEADS EXIST UTILIZING THE COMBINED FOUR ZONE PROOF PRESSURE TEST FROM THE HOT GAS MANIFOLD. CEI REQUIREMENTS ARE MAINTAINED	HOT GAS MANIFOLD PROOF PRESSURE TEST ACCOMPLISHED SEPARATELY PRIOR TO COOLANT DUCT AND MAIN INJECTOR INSTALLATION.	R0017443