

SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group: Block 1 Ducts and Lines
 CIL Item: K653-01
 Part Number: R039138
 Component: HPOTP Turbine Bearing Purge Line (ATD Configured Engine)
 FMEA Item: K653
 Failure Mode: Fails to contain hydrogen.

Prepared: D. Early
 Approved: T. Nguyen
 Approval Date: 7/25/00
 Change #: 1
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Page: 1 of 1

Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Deprivation of hydrogen coolant flow to ATD HPOTP turbine labyrinth seal, ingestion of hot gas into bearing cavity causing a possible bearing failure. Line failure internal of heat shield would also result in leakage into aft compartment and overpressurization of aft compartment. Loss of vehicle.	1 ME-FD3S,A,M,C, ME-A1A
Redundancy Screens: SINGLE POINT FAILURE: N/A		

**SSME EA/CIL
DESIGN**

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Design / Document Reference

FAILURE CAUSE: A: Parent material failure or weld failure.
B: Parent material failure of plate.

THE LINE ASSEMBLY (1) AND PLATE (2) ARE MANUFACTURED UTILIZING INCONEL 625 TUBE AND BAR. INCONEL 625 WAS SELECTED FOR ITS WELDABILITY, FORMABILITY, RESISTANCE TO STRESS CORROSION CRACKING, AND CORROSION RESISTANCE (3). INCONEL 625 IS NOT SIGNIFICANTLY EFFECTED BY HYDROGEN IN THIS ENVIRONMENT (3). INCONEL 625 POSSESSES THE REQUIRED STRENGTH WITHOUT REQUIRING HEAT TREAT. A STIFFENER IS INCORPORATED ACROSS THE PLATE TO PREVENT FLANGE DISTORTION UNDER PRESSURE. THE STIFFENER INCORPORATES RADII TO PREVENT STRESS RISERS. FLANGE SECTION INCORPORATES RADIUS JOINTS TO REDUCE STRESS CONCENTRATIONS. OFFSET LIMIT REQUIREMENTS ARE ESTABLISHED TO REDUCE STRESS CONCENTRATIONS AND IMPROVE WELD GEOMETRY. TUBING STOCK IS DRAWN TO MAINTAIN SURFACE REGULARITY. INSTALLATION IS CONTROLLED FOR ANGULARITY AND OFFSET PER SPECIFICATION REQUIREMENTS (4). MINIMUM FACTORS OF SAFETY FOR THE LINE MEET CEI REQUIREMENTS (5). HIGH AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (6). THE LINE ASSEMBLY HAS COMPLETED PRESSURE CYCLING AND ULTIMATE PRESSURE DVS TESTING (7). THE PLATE WAS DVS TESTED DURING ENGINE DVS TESTING (8). THE LINE ASSEMBLY PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (9). TABLE K653 LISTS ALL THE 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. THESE WELDS HAVE BEEN ASSESSED AS ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (10).

(1) R039138; (2) R0011086; (3) RSS-8582; (4) RA1102-006; (5) RSS-8546, CP320R0003B; (6) RL00532, CP320R0003B; (7) RSS-511-31, RSS-511-45; (8) DVS-SSME-101; (9) NASA TASK 117; (10) RSS-8756

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INSPECTION AND TEST

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Page: 1 of 1

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
ALL CAUSES	LINE		R039138
	FLANGE		R039306
	FLANGE		R039331
	PLATE		R0011086
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS. DETAILS ARE PENETRANT INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS.	R039138 R039306 R039331 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.	RL10011 RA0607-094 RA0115-116 RA0115-006 RA1115-001 RA0115-127
	ASSEMBLY INTEGRITY	THE ASSEMBLY IS PROOF PRESSURE TESTED PER DRAWING REQUIREMENTS. THE PLATE STIFFENER RADII ARE INSPECTED PER DRAWING REQUIREMENTS.	R039138 R0011086
	FLIGHT FLOW TESTING	THE EXTERNAL SURFACE IS VISUALLY INSPECTED PRIOR TO EACH LAUNCH. THE PLATE AND SEAL ARE LEAK CHECKED EACH FLIGHT. A HELIUM SIGNATURE LEAK TEST IS PERFORMED PRIOR TO EACH LAUNCH. (LAST TEST)	OMRSD V41BU.030 OMRSD V41GEN.565 OMRSD S00000.950

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)

Reference: NASA letter SA21/88/308 and Rocketdyne letter 88RC09761.

Operational Use: Not Applicable.

SSME EA/CIL
WELD JOINTS

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 Page: 1 of 1

Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
LINE	R039138	1,2	GTAW	I		X	X	