

SSME EA/CIL  
REDUNDANCY SCREEN

Component Group: Igniters and Sensors  
CIL Item: J301-AA-03, J302-AA-03  
Component: HPFTP Turbine Discharge Temp Thermocouple Sensors (G5.1, G5.2)  
Part Number: RE1751, RE1751  
Failure Mode: Leakage into sensor housing.

Prepared: M. Oliver  
Approved: T. Nguyen  
Approval Date: 3/30/99  
Change #: 2  
Directive #: CCBO ME3-01-4994  
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Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Leakage results in housing failure, Overpressurization of aft compartment, Loss of vehicle.  Redundancy Screens: SINGLE POINT FAILURE: N/A.	↑ ME-D35,A,M,C

**SSME FMEA/CIL**  
**DESIGN**

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Design / Document Reference

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**FAILURE CAUSE: ALL CAUSES**

THE HOT GAS TEMPERATURE SENSOR PROBE HOUSING IS MADE FROM INCONEL 625. INCONEL 625 WAS SELECTED FOR ITS TENSILE STRENGTH, RESISTANCE TO GENERAL CORROSION, WELDABILITY TO 300 SERIES CRES, AND RESISTANCE TO STRESS CORROSION CRACKING (1), (2). HYDROGEN ENVIRONMENT EFFECTS ARE NOT CONSIDERED A PROBLEM UNDER THESE CONDITIONS OF USE (1). THE SHIELD IS GAS TUNGSTEN ARC WELDED TO THE PROBE HOUSING (3). PROCESSES USED FOR INTERNAL PROBE BRAZING AND HOUSING WELDING ARE CONTROLLED BY SPECIFICATION (3).

THE SENSORS ARE A VENDOR ITEM. DRAWING SPECIFICATION AND MANUFACTURING PROCESSES ARE CONTROLLED BY ROCKETDYNE (3). ALL SENSOR DESIGNS ARE SUBJECTED TO A CRITICAL DESIGN REVIEW. ANY DESIGN CHANGES ARE RE-REVIEWED (3). SENSORS HAVE COMPLETED USEFUL LIFE TESTING (3), INCLUDING VIBRATION TESTING (3). THE MINIMUM FACTORS OF SAFETY MEET CEI REQUIREMENTS (4). THE SENSORS WERE ANALYZED FOR HIGH CYCLE FATIGUE AND LOW CYCLE FATIGUE LIFE AND MEET CEI REQUIREMENTS (5).

(1) RSS-85E2; (2) MSFC-SPEC-622; (3) RC1751; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B

**SSME FN /CIL  
INSPECTION AND TEST**

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
ALL CAUSES	TEMPERATURE TRANSDUCER		RE1751
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RC1751
	BRAZE INTEGRITY	BRAZING IS INSPECTED PER SPECIFICATION REQUIREMENTS.	
	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.	
	ASSEMBLY INTEGRITY	AFTER THE CASE IS WELDED, HELIUM LEAK TESTS ARE PERFORMED TO VERIFY HERMETIC SEAL. ALL VENDOR INSPECTION AND TEST CRITERIA IS UNDER ROCKETDYNE APPROVAL AND CONTROL. TRANSDUCERS ARE SUBJECTED TO A WORKMANSHIP SCREENING ACCEPTANCE TEST INCLUDING VIBRATION AND THERMAL CYCLE.	
	HOT FIRE ACCEPTANCE TESTING (GREEN RUN)	SENSOR OPERATION IS VERIFIED THROUGH HOT FIRE ACCEPTANCE TESTING.	RL00461
	DATA REVIEW	ALL CONTROLLER DATA FROM THE PREVIOUS FLIGHT OR HOT FIRE IS REVIEWED. ANY ANOMALOUS CONDITION NOTED REQUIRES FURTHER TESTING OR HARDWARE REPLACEMENT PRIOR TO THE NEXT FLIGHT.	MSFC PLN 1228
	PRE-FLIGHT CHECKOUT	SENSORS ARE VISUALLY INSPECTED.	OMRSD V41BU0.030
		SENSORS ARE DYE PENETRANT INSPECTED FOR CRACKS AFTER EVERY FLIGHT.	OMRSD V41BU0.225
		SENSOR OPERATION IS VERIFIED EVERY MISSION FLOW BY SUCCESSFUL COMPLETION OF THE CONTROLLER SENSOR ELECTRICAL CHECKOUT. (LAST TEST)	OMRSD V41AQ0 010 OMRSD 800FA0 213

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)  
 Reference: NASA letter SA21/88:305 and Rocketdyne letter 88RC0976

Operational Use: Not Applicable.

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