

**SSME FMEA/CIL**  
**REDUNDANCY SCREEN**

Component Group: Igniters and Sensors  
CIL Item: J312-03  
Component: HPOTP Boost Stage Discharge Temp Transducer (O11.1.2)  
Part Number: REST002  
Failure Mode: Leakage into sensor housing.

Prepared: M. Oliver  
Approved: T. Nguyen  
Approval Date: 3/30/99  
Change #: 1  
Directive #: CCBD ME3-01-4894  
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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	1 ME-C3S.M.A.C

**SSME MEA/CIL  
DESIGN**

Component Group: Igniters and Sensors  
CIL Item: J312-03  
Component: HPOTP Boost Stage Discharge Temp Transducer (O11.1.2)  
Part Number: RES7002  
Failure Mode: Leakage into sensor housing.

Prepared: M. Oliver  
Approved: T. Nguyen  
Approval Date: 3/30/98  
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Design / Document Reference

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**FAILURE CAUSE:** A: Parent material or braze failure.

THE CRYOGENIC 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). THE REAR HOUSING IS MANUFACTURED FROM 321 CRES. THIS MATERIAL WAS SELECTED FOR ITS STRENGTH, WELDABILITY, CORROSION RESISTANCE, AND RESISTANCE TO STRESS CORROSION CRACKING (1), (2). 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 ROCKETOYNE (3). ALL SENSOR DESIGNS ARE SUBJECTED TO A CRITICAL DESIGN REVIEW. ANY DESIGN CHANGES ARE RE-REVIEWED (3). SENSORS HAVE COMPLETED DESIGN VERIFICATION TESTING (4), INCLUDING VIBRATION TESTING (5). THE MINIMUM FACTORS OF SAFETY MEET CEI REQUIREMENTS (6). THE SENSORS WERE ANALYZED FOR HIGH CYCLE FATIGUE AND LOW CYCLE FATIGUE LIFE AND MEET CEI REQUIREMENTS (7).

(1) RSS-9562; (2) MSFC-SPEC-522; (3) RC7002; (4) OVS-SSME-203, RSS-86ED; (5) RSS-203-11; (6) RSS-8546, CP320R0003B; (7) RL00532, CP320R0003B

**SSME FMEA/CIL  
INSPECTION AND TEST**

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	TEMPERATURE TRANSDUCER		RES7002
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RC7002
	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.	RI.00461
	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. SENSOR OPERATION IS VERIFIED EVERY MISSION FLOW BY SUCCESSFUL COMPLETION OF THE CONTROLLER SENSOR ELECTRICAL CHECKOUT. (LAST TEST)	OMRSD V41BLD.030 OMRSD V41AQ0.010 OMRSD S00FA0.213

J-176

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**

Component Group: Igniters and Sensors  
 CIL Item: J312  
 Component: HPOTP Boost Stage Discharge Temp Transducer (O11.1.2)  
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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	
TEMPERATURE TRANSDUCER	RES7002	R2	GTAW	II	X			
TEMPERATURE TRANSDUCER	RES7002	R2A	GTAW	II	X			