

**SSME MEA/CIL  
REDUNDANCY SCREEN**

Component Group: Igniters and Sensors  
 CIL Item: J352-01  
 Component: AFV Skin Temperature Sensor  
 Part Number: R0014028/R0015969  
 Failure Mode: Erroneous output signal.

Prepared: M.Oliver  
 Approved: T. Nguyen  
 Approval Date: 3/31/89  
 Change #: 1  
 Directive #: CCBD ME3-01-4994  
 Page: 1 of 1

Phase	Failure / Effect Description	Criticality Hazard Reference
P 4.2	Erroneous output signal within LCC limits results in loss of valve leakage protection. Loss of vehicle due to heat exchanger failure if AFV leakage exists and is not detected.  Redundancy Screens: SENSOR SYSTEM - VALVE SYSTEM: UNLIKE REDUNDANCY  A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround. B: Fail - Loss of a redundant hardware items is not detectable during flight. C: Fail - Loss of redundant hardware items could result from a single credible event.	1R ME-835

**SSME FMEA/CIL  
DESIGN**

Component Group: Igniters and Sensors  
CIL Item: J352-01  
Component: AFV Skin Temperature Sensor  
Part Number: R001402B/R0015969  
Failure Mode: Erroneous output signal.

Prepared: M. Dilver  
Approved: T. Ngiyan  
Approval Date: 3/30/99  
Change #: 1  
Directive #: CCBD ME3-01-4994

Page: 1 of 1

Design / Document Reference

**FAILURE CAUSE: A: Open or short in sensor leadwires.**

ELECTRONIC, ELECTRICAL, AND ELECTROMECHANICAL PARTS FOR THE TRANSDUCER INVOLVED IN THIS FUNCTION HAVE BEEN SELECTED FROM THE CLASS S OR EQUIVALENT APPROVED PARTS SELECTION (1). THE TRANSDUCER ELEMENT IS MADE FROM REFERENCE PURITY PLATINUM WIRES MOUNTED IN A STRAIN-FREE MANNER. THE ELEMENT IS PROTECTED BY A METALLIC COVER AND THE PLATINUM LEADWIRES ARE PROTECTED BY A METAL-OXIDE INSULANT AND A PLATINUM-RHODIUM SHEATH (2). PROCESSES USED FOR BRAZING AND WELDING ARE CONTROLLED BY SPECIFICATION (2). LEADWIRE CONNECTIONS ARE BRAZED IN A STRAIN-FREE MANNER. POTTING SURROUNDING THE LEADWIRE CONNECTIONS PREVENTS WIRE MOVEMENT AND SUBSEQUENT WIRE FAILURE (3). THE LEADWIRE CONNECTIONS AND POTTING IS ENCASED IN A STAINLESS STEEL TRANSITION SLEEVE FOR PROTECTION

(1) 85M0392B; (2) RC1345; (3) RL1000B

**FAILURE CAUSE: B: De-bonding of sensor from skin.**

A POLYURETHANE ADHESIVE (CREST 810) AND OPEN-WEAVE GLASS FABRIC ARE USED TO BOND THE SENSOR ONTO THE MFV, OPOV, AND AFV DUCT SURFACES. THESE MATERIALS WERE CHOSEN BECAUSE OF THEIR SUPERIOR BONDING CAPABILITIES IN SEVERE THERMAL AND VIBRATION ENVIRONMENTS. THE SKIN TEMPERATURE SENSOR IS CAREFULLY FORMED TO ASSURE A RELAXED CONTACT OF THE TRANSDUCER ON THE MOUNTING SURFACE. INSTALLATION OF THE SENSOR TO THE DUCT SURFACES IS RIGIDLY CONTROLLED BY SPECIFICATION (1).

(1) RA1506-013

**FAILURE CAUSE: C: Open splices.**

MATERIAL SELECTION OF THE WIRES, INSULATORS, CONNECTORS, AND ASSEMBLY TECHNIQUES ARE CONTROLLED BY SPECIFICATION (1) TO GUARD AGAINST THE FAILURE OF THE SENSORS IN THE ENVIRONMENTS IT IS EXPOSED TO. THESE CONTROLS ARE ESTABLISHED BY GOVERNMENT SPECIFICATIONS FOR WIRE SELECTION (2), AND ARE KEYED TO THE FUNCTION AND USAGE OF THE HARDWARE. IN ADDITION TO SPECIFICATION REQUIREMENTS, THE ASSEMBLY IS TESTED FOR INTEGRITY. THE HARNESS/SENSOR DESIGN IS TESTED PER HARNESS DESIGN VERIFICATION TESTING (3), INCLUDING VIBRATION TESTING (4), SAFETY FACTOR CRITERIA TESTING (5), AND DURING SENSOR VIBRATION TESTING (6), WHERE THE FLIGHT DESIGNED HARNESS IS CONNECTED TO THE SENSOR UNDER TEST. TO PREVENT TEMPERATURE RELATED EMBRITTLEMENT OF THE CONDUCTOR OR INSULATOR, WIRES ARE OF SUCH CROSS SECTION AS TO PROVIDE AMPLE AND SAFE CURRENT CARRYING CAPACITY. THE MAXIMUM DESIGN CURRENT IN ANY WIRE IS LIMITED SO THAT "WIRE TOTAL TEMPERATURE" WILL NEVER EXCEED THE RATED WIRE TEMPERATURE (1). SPLICING OF CONDUCTORS IS CONTROLLED BY SPECIFICATION REQUIREMENTS (7)

(1) RL100-4; (2) 40M50577, 40M50578; (3) DVS-SSME-202; (4) RSS-202-6; (5) RSS-202-20; (6) DVS-SSME-203; (7) RA1603-033

**SSME FM /CIL  
INSPECTION AND TEST**

Component Group: Igniters and Sensors  
 CIL Item: J352-01  
 Component: AFV Skin Temperature Sensor  
 Part Number: R0014028/R0016969  
 Failure Mode: Erroneous output signal.

Prepared: M. Oliver  
 Approved: T. Nguyen  
 Approval Date: 3/30/99  
 Change #: 1  
 Directive #: CCBD MEJ-01-4994

Page: 1 of 2

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	SKIN TEMP SENSOR		RES1345
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RC1345
	ASSEMBLY INTEGRITY	ALL VENDOR INSPECTION AND TEST CRITERIA IS UNDER ROCKETDYNE APPROVAL AND CONTROL.	
		THE FOLLOWING TESTS AND INSPECTIONS ARE PERFORMED DURING MANUFACTURING AND ACCEPTANCE TESTING: - EXAMINATION OF PRODUCT. - INSULATION RESISTANCE TEST BETWEEN ELEMENT AND CASE. - DIELECTRIC WITHSTANDING VOLTAGE TEST. - CALIBRATION AND CALIBRATION VERIFICATION. - TIME CONSTANT VERIFICATION. - PROOF PRESSURE TEST.	RC1345 RC1345 RC1345 RC1345 RC1345 RC1345 RC1345
B	SKIN TEMP SENSOR		RES1345
	CLEANLINESS	CLEANLINESS REQUIREMENTS ARE VERIFIED PER SPECIFICATION REQUIREMENTS DURING MANUFACTURING AND INSTALLATION OF THE SKIN TEMP SENSORS.	RS007007 RC1345 RA1606-013
		THE AREA WHERE THE SENSOR IS TO BE INSTALLED IS CLEANED AND DRIED PER SPECIFICATION REQUIREMENTS.	RA1606-013
		RATIO OF ADHESIVE TO CURING AGENT IS CONTROLLED PER SPECIFICATION REQUIREMENTS. INSTALLATION IS INSPECTED FOR ANY EVIDENCE OF DEBONDING PRE- AND POST-ADHESIVE CURE. GLASS FABRIC REINFORCEMENT INSTALLATION IS CONTROLLED PER SPECIFICATION REQUIREMENTS.	
C	ELECTRICAL HARNESS		R0014028 / R0015969
	INTEGRITY OF CONNECTOR AND HARNESS ASSEMBLY	THE FOLLOWING TESTS ARE PERFORMED DURING MANUFACTURING AND ASSEMBLY ACCEPTANCE: - ALL CONTACTS IN THE CONNECTORS AND SKIN TEMP SENSORS ARE SUBJECTED TO A RETENTION TEST - EACH WIRE RUN IS VERIFIED FOR END TO END CONTINUITY - INSULATION RESISTANCE BETWEEN EACH CONDUCTOR AND EVERY OTHER CONDUCTOR IS VERIFIED TO BE WITHIN SPECIFICATION. - INSULATION RESISTANCE OF SKIN TEMP SENSOR	RL00113, RL00457 RL00128 RL00128, RL00457 RL00457
	INSULATION INTEGRITY	INSTALLATION OF THE HARNESSES IS CONTROLLED PER SPECIFICATION DEFINING THE: - INSPECTION OF HARNESSES/SENSORS PRE- AND POST-INSTALLATION. - MINIMUM BEND RADIUS. - RE-TEST OF HARNESS FOLLOWING SPLICE.	RL00113 RL10014 RA1613-003

J - 187

Component Group: Igniters and Sensors  
 CIL Item: J352-01  
 Component: AFV Skin Temperature Sensor  
 Part Number: R0014028/R0015969  
 Failure Mode: Erroneous output signal.

Prepared: M. Oliver  
 Approved: T. Nguyen  
 Approval Date: 3/30/98  
 Change #: 1  
 Directive #: CCBD ME3-01-4994  
 Page: 2 of 2

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
ALL CAUSES	FLIGHT FLOW TESTING	<p>RETEST REQUIREMENTS AFTER HARNESS REPLACEMENT OR CONNECTOR DEMATE VERIFY THAT THE PROPER CONTROLLER ELECTRICAL CHECKOUTS ARE PERFORMED TO RE-VALIDATE THE HARNESS ASSEMBLY.</p> <p>HARNESSES ARE INSPECTED FOR DAMAGE AND PROPER ROUTING DURING AFT CLOSEOUT INSPECTION.</p> <p>CONNECTORS ARE INSPECTED FOR PROPER MATING, EVIDENCE OF CORROSION, AND ANY DAMAGE WHICH COULD CAUSE THE CONNECTOR TO FAIL.</p> <p>ALL SKIN TEMP DATA FROM THE PREVIOUS FLIGHT IS REVIEWED. ANY ANOMALOUS CONDITION NOTED REQUIRES FURTHER TESTING OR HARDWARE REPLACEMENT PRIOR TO THE NEXT FLIGHT.</p> <p>HARNESS AND SKIN TEMP SENSOR OPERATION IS VERIFIED PRIOR TO EVERY FLIGHT. (LAST TEST)</p>	<p>OMRSD V41ZA0.010</p> <p>OMRSD V41BU0.030 OMRSD V41BU0.070</p> <p>MSFC PLN 1228</p> <p>OMRSD V41AU0.013</p>

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA) Reference. NASA letter SA21/88/308 and Rocketdyne letter RRRC09761.  
 Operational Use: Not Applicable.

J - 188