

**SSME FMEA/CIL  
REDUNDANCY SCREEN**

Component Group: Propellant Valves  
 CIL Item: D300-05  
 Component: Anti-flood Valve  
 Part Number: R3007063  
 Failure Mode: Erroneous position feedback signal.

Prepared: P. Lowrimore  
 Approved: T. Nguyen  
 Approval Date: 5/30/99  
 Change #: 1  
 Directive #: CCBD ME3-01-5226  
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Phase	Failure / Effect Description	Criticality Hazard Reference
S 4.2	<p>Failure causing erroneous signal on both qualified channels or remaining qualified channel within ignition confirmed limits, results in loss of protection against failure of valve to open. Loss of vehicle due to heat exchanger failure may result if AFV fails to open and is not detected.</p> <p>Redundancy Screens: SENSOR SYSTEM - VALVE SYSTEM: UNLIKE REDUNDANCY</p> <p>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: Pass - Loss of redundant hardware items could not result from a single credible event.</p>	1R ME-B3S

**SSME FA/CIL  
DESIGN**

Component Group: Propellant Valves  
CIL Item: 0300-05  
Component: Anti-flood Valve  
Part Number: RS007083  
Failure Mode: Erroneous position feedback signal.

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Design / Document Reference

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**FAILURE CAUSE: A: Damaged armature.**

THE ARMATURE (1) IS MANUFACTURED FROM AL 4750. MATERIAL IS SELECTED FOR ITS MAGNETIC PERMEABILITY AND COERCIVE FORCE. THE HOUSING (1) PROTECTS THE ARMATURE FROM THE OUTSIDE ELEMENTS. THE MINIMUM DIAMETRICAL CLEARANCE BETWEEN ARMATURE O.D. AND THE TRANSFORMER HOUSING BORE IS CONTROLLED (1) (2). THE ARMATURE IS DRY-FILM LUBRICATED (2). THE EXTENSION (1) IS HEAT TREATED INCONEL 718. THE EXTENSION IS THREADED INTO THE ARMATURE AND THE JOINTS ARE BRAZED FOR STRUCTURAL INTEGRITY.

(1) Q2306; (2) RES1258

**FAILURE CAUSE: B: Open or short circuit.**

**C: Change of internal resistance caused by moisture, corrosion, or contamination.**

PARTS FOR THE CIRCUITS INVOLVED IN THIS FUNCTION HAVE BEEN SELECTED FROM THE MSFC CLASS S OR EQUIVALENT APPROVED PARTS SELECTION (1). ELECTRICAL CONNECTOR IS DESIGNED TO SEAL AGAINST MOISTURE/CONTAMINATION (2). RECEPTACLE PINS ARE NICKEL UNDERPLATED AND GOLD OVERPLATED TO PREVENT CORROSION (3). POTTING COMPOUND (4) FILLS ALL CAVITIES AND PREVENT WIRE MOVEMENT. THE CAVITY IS EVACUATED AND BACK-FILLED WITH HELIUM. A BALL IS RESISTANCE WELDED TO THE HOUSING ACCESS PORT. THE BALL RECESS IS POTTED (4) FLUSH WITH TOP OF FLANGE. THIS DESIGN PREVENTS MOISTURE/CONTAMINATION PROBLEMS (5). SOLDERING OF ELECTRICAL CONNECTIONS AND TERMINAL CONNECTIONS ARE CONTROLLED BY SPECIFICATION (6). PRIMARY AND SECONDARY COILS ARE DESIGNED SO THEY ARE INSULATED FROM EACH OTHER. DUAL COILS AND ELECTRICAL CONNECTORS PROVIDE ELECTRICAL REDUNDANCY. THE ANTI-FLOOD VALVE WITH THE POSITIONING INDICATOR ATTACHED HAS SUCCESSFULLY PASSED DESIGN VERIFICATION TESTING (7), WHICH INCLUDED PRESSURE CYCLING (8), AND VIBRATION TESTING (8).

(1) 65M03928; (2) RES1232; (3) MSFC-SPEC-250; (4) RL10008; (5) Q2308; (6) MSFC-SPEC-270; (7) DVS-SSME-508; (8) RSS-508-32, RSS-508-33, RSS-508-34

**SSME FMEA/CIL**  
**INSPECTION AND TEST**

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	POSITION INDICATOR		RES1255
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	
		ARMATURE DRY-FILM LUBRICATION IS INSPECTED PER SPECIFICATION AND DRAWING REQUIREMENTS.	RB0140-017 RES1255
		DIAMETRICAL CLEARANCE BETWEEN ARMATURE AND TRANSFORMER BORE IS INSPECTED PER DRAWING REQUIREMENTS.	RES1258
		ARMATURE BRAZING IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RC1258
B, C	POSITION INDICATOR		RES1258
	PLATING INTEGRITY	THE PLATING IS VERIFIED PER SPECIFICATION REQUIREMENTS.	
	SOLDERING INTEGRITY	ELECTRICAL SOLDERING IS INSPECTED PER SPECIFICATION REQUIREMENTS	
	ASSEMBLY CLEANLINESS	CLEANLINESS IS VERIFIED DURING ASSEMBLY AND TESTING PER SPECIFICATION REQUIREMENTS.	RL10001 RES1258
	ASSEMBLY INTEGRITY	EACH TRANSDUCER IS EXAMINED FOR QUALITY OF WORKMANSHIP PER SPECIFICATION REQUIREMENTS.	RES1258
		THE FOLLOWING TESTS ARE PERFORMED DURING MANUFACTURING AND ACCEPTANCE TESTING: - INSULATION RESISTANCE BETWEEN COILS AND CASE - DIELECTRIC WITHSTANDING VOLTAGE TEST TO VERIFY CURRENT LEAKAGE IS WITHIN SPECIFICATION REQUIREMENTS. - STROKE DEFLECTION TESTS TO VERIFY PROPER DISPLACEMENT, OUTPUT VOLTAGE, AND PHASING. - SCALE FACTOR AND LINEARITY TEST. - LOW TEMPERATURE FUNCTIONAL TEST. - HELIUM BACK FILL AND LEAK TEST.	
	WELD INTEGRITY	ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS.	RL10011 RA1607-C71

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
ALL CAUSES	HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)	VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING.	RL00461
	PRE-FLIGHT CHECKOUT	THE AFV FUNCTIONAL TEST PERFORMED PRIOR TO EACH FLIGHT VERIFIES FULL OPEN POSITION INDICATION.	OMRSD V41BR0.030
		SENSOR CHECKOUT VERIFIES LVDT ELECTRONICS PRIOR TO EACH FLIGHT.	OMRSD S00FA0.213
		CONTROLLER POWER-UP PROVIDES CONTINUOUS VALVE POSITION MONITORING AND LVDT OPERATION CHECK. (LAST TEST)	

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 / TA/CIL**  
**WELD JOINTS**

Component Group: Propellant Valves  
 CIL Item: D300  
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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	
ANTI-FLOOD VALVE	RS007083	5	EBW	II	X			
ANTI-FLOOD VALVE	RS007083	6	EBW	II	X			