

SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group: Propellant Valves
CIL Item: DJ00-01
Component: Anti-flood Valve
Part Number: RS007083
Failure Mode: Leakage.

Prepared: P. Lowrmore
Approved: T. Nguyen
Approval Date: 8/30/99
Change #: 1
Directive #: CCBD ME3-01-5226
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Phase	Failure / Effect Description	Criticality Hazard Reference
PS 4.1	LOX flows to heat exchanger; heat from start causes GOX to overpressurize and rupture the heat exchanger coils; LOX and hot-gas mix. uncontained fire/explosion Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A.	1 ME-B3S

SSME FA/CIL
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Design / Document Reference

FAILURE CAUSE: A: Poppet or seat fractured/damaged.

THE ANTI-FLOOD VALVE POPPET (1) IS MADE FROM TUNGSTEN CARBIDE. TUNGSTEN CARBIDE WAS SELECTED FOR ITS RESISTANCE TO WEAR, HIGH HARDNESS, AND ITS VIRTUALLY POROSITY FREE STRUCTURE. THE MATERIAL IS CORROSION RESISTANT AND, WHEN USED IS NOT SUBJECT TO STRESS CORROSION CRACKING (2). THE AFV SEAT (3) IS MADE FROM INCONEL 718 WHICH IS HARDFACED FOR ADDITIONAL WEAR RESISTANCE. INCONEL 718 IS USED FOR ITS HIGH STRENGTH, CORROSION RESISTANCE, AND STRESS CORROSION RESISTANCE. AFTER HARDFACING, THE SEAT IS SOLUTION HEAT TREATED AND AGED (2). THE POPPET IS DESIGNED TO PIVOT TO ALIGN WITH THE SEAT (4). THIS PROVIDES PROPER SEALING AND DISTRIBUTES THE LOADS ACROSS THE ENTIRE SEALING SURFACE.

(1) RS008225; (2) RSS-8582; (3) R0019127; (4) RS007083

FAILURE CAUSE: B: Contamination.

THE ANTI-FLOOD VALVE INCORPORATES A 100-MICRON FILTER (1) IN THE INLET TO MINIMIZE CONTAMINANTS ENTERING THE VALVE. THE VALVE COMPONENTS ARE CLEANED TO LOX SERVICE OR BETTER REQUIREMENTS (2). THE AFV IS ASSEMBLED IN A CONTAMINATION CONTROLLED AREA (3). ALL FUNCTIONAL TESTS ARE PERFORMED WITH CONTAMINATION CONTROLLED FLUIDS (3). THE AFV FILTER IS CHANGED PRIOR TO EACH FLIGHT TO ASSURE FILTER CAPACITY IS NOT REDUCED DUE TO PREVIOUS OPERATION (4).

(1) 266-5008; (2) RL10001; (3) RQ0711-600; (4) OMRSD V41BU0.220

FAILURE CAUSE: C: Fractured poppet or piston springs.

THE AFV PISTON SPRING (1) IS MADE FROM ELGILOY WIRE WHICH HAS BEEN CENTERLESS GROUND AND SHOT PEENED. ELGILOY IS USED FOR ITS HIGH STRENGTH, ELASTIC LIMIT, AND ELASTIC MODULUS. IT IS CORROSION RESISTANT AND RESISTANT TO STRESS CORROSION CRACKING (2). THE SPRING WIRE IS CENTERLESS GROUND TO ASSURE NO SURFACE DEFECTS EXIST. SHOT PEENING REDUCES SURFACE STRESSES AND FRACTURE POTENTIAL. THE SPRING IS HEAT TREATED AND AGED (1). THE POPPET SPRING (3) IS MADE FROM 302 CRES WHICH IS WORK HARDENED AND STRESS RELIEVED. THE MATERIAL WAS SELECTED FOR ITS TORSIONAL STRENGTH IN THE WORK HARDENED CONDITION. 302 CRES IS CORROSION AND STRESS CORROSION RESISTANT (2).

(1) R0019124; (2) RSS-8582; (3) RS008227

FAILURE CAUSE: ALL CAUSES

DOWNSTREAM TEMPERATURE MEASUREMENTS VERIFY AFV IS OPERATING PROPERLY PRIOR TO START. SATISFACTORY TEMPERATURES ARE VERIFIED AS PART OF THE LAUNCH COMMIT CRITERIA (1) PRIOR TO ENGINE START. THE HIGH CYCLE AND LOW CYCLE FATIGUE LIFE OF THE ANTI-FLOOD VALVE MEETS CEI REQUIREMENTS (2). THE MINIMUM FACTORS OF SAFETY FOR THE AFV MEETS CEI REQUIREMENTS (3). THE AFV WAS CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH, SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (4). THE ANTI-FLOOD VALVE SUCCESSFULLY COMPLETED DVS TESTING REQUIREMENTS (5), INCLUDING VIBRATION (6), AND ENDURANCE (7).

(1) JSC 16007; (2) RL00532, CP320R0003B; (3) RSS-8546, CP320R0003B; (4) NASA TASK 117; (5) DVS-SSME-508; (6) RSS-508-33, RSS-508-34; (7) RSS-508-32

**SSME FMEA/CIL
INSPECTION AND TEST**

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	POPPET SEAT		RS008226 R0019127
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS. THE PISTON, POPPET, AND SEAT ARE PENETRANT INSPECTED AFTER FINAL MACHINING.	RA0115-116
	POPPET & SEAT SEALING SURFACE FINISH	THE SEAT SEALING SURFACE IS INSPECTED TO CLASS A REQUIREMENTS PER SPECIFICATION.	RL00133
		THE POPPET AND SEAT SEALING SURFACES ARE REINSPECTED PRIOR TO INSTALLATION INTO VALVE.	RL00460
B	ANTI-FLOOD VALVE FILTER		RS007083 286-5008
	100-MICRON TYPE 1 FILTERING	FILTER CAPABILITY IS VERIFIED PER SPECIFICATION REQUIREMENTS. THE FILTER IS CHANGED PRIOR TO EACH FLIGHT.	RC286-5008 OMRSD V418U0 220
	VALVE CLEANLINESS	CLEANLINESS REQUIREMENTS ARE VERIFIED DURING MANUFACTURING AND ASSEMBLY OF THE VALVE. VALVE IS ASSEMBLED IN A CONTAMINATION CONTROLLED ENVIRONMENT.	RL00460 RL10001 RA1610-009 RQ0711-600
C	SPRING		R0019124
	SPRING INTEGRITY	MATERIAL INTEGRITY IS INSPECTED PER DRAWING REQUIREMENTS. THE SPRING IS DYE PENETRANT INSPECTED BEFORE AND AFTER FORMING. THE SPRING IS INSPECTED TO ASSURE NO SURFACE IMPERFECTIONS EXIST WHICH COULD AFFECT COIL LIFE AND TO VERIFY THE SPRING CHARACTERISTICS.	RA0115-116 RA0102-012 R0019124
ALL CAUSES	ANTI-FLOOD VALVE		RS007083
	ANTI-FLOOD VALVE INTEGRITY	THE COMPLETED VALVE IS PROOF PRESSURE, FUNCTIONAL, AND LEAK TESTED.	RL00460
	HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)	VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING. THE VALVE OPERATION IS VERIFIED BY VALVE CRACKING, FULL OPEN, AND RESEAT PRESSURE TESTS BEFORE EACH FLIGHT. THE POPPET TO SEAT SEAL IS TESTED PRIOR TO EACH FLIGHT, AND VERIFIED CLOSED BY THE POSITION INDICATOR PRIOR TO LAUNCH COMMIT. (LAST TEST)	RL00461 OMRSD V418RC.030 OMRSD V418C0.100

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Failure History:	Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA) Reference: NASA letter SA21/88/308 and Rockaldyna letter 88RC09761.		
Operational Use:	Not Applicable.		

**SSME / TA/CIL
WELD JOINTS**

Component Group: Propellant Valves
 CIL Item: D300
 Component: Anti-flood Valve
 Part Number: RS007083

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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			