

**SSME FMEA/CIL
REDUNDANCY SCREEN**

Component Group: Propellant Valves
 CIL Item: D300-03
 Component: Anti-flood Valve
 Part Number: R5007083
 Failure Mode: LOX flow restricted or shutoff.

Prepared: P. Lowrimore
 Approved: T. Nguyen
 Approval Date: 5/30/99
 Change #: 1
 Directive #: CCBO ME3-01-5226
 Page: 1 of 1

Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Loss of pressurant flow to accumulator and vehicle. Collapse and possible cracking of heat exchanger coil; hot-gas flow to vehicle oxidizer tank and pogo accumulator; loss of pogo suppression. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A.	1 ME-B3S, ME-B3A,M,C

**SSME / FACIL
DESIGN**

Component Group: Propellant Valves
CIL Item: D300-03
Component: Anti-flood Valve
Part Number: R9007083
Failure Mode: LOX flow restricted or shutoff.

Prepared: P. Lowrimore
Approved: T. Nguyen
Approval Date: 6/30/99
Change #: 1
Directive #: CCBD ME3-01-5226
Page: 1 of 1

Design / Document Reference

FAILURE CAUSE: A: Blocked Inlet filter.

THE INLET FILTER (1) INCORPORATES A CONE DESIGN TO PROVIDE A LARGE SURFACE AREA AND REDUCE BLOCKAGE POTENTIAL. THE FILTER IS DESIGNED TO HOLD .275 GRAMS OF CONTAMINATION BEFORE FLOW IS REDUCED. THE FLOW RATE THROUGH THE FILTER MUST BE ACCEPTABLE WITH 25% OF THE FILTER BLOCKED OFF (2). THE LOX SUPPLY TO THE AFV IS FILTERED TO 800-MICRONS (3). ALL UPSTREAM COMPONENTS ARE CLEANED TO LOX SERVICE OR BETTER REQUIREMENTS (4).

(1) 286-5008; (2) RC288-5008; (3) ICD 13M15000; (4) RL10001

FAILURE CAUSE: B: Vent passage blocked and cracked piston or piston seal leakage.

DETAIL PARTS AND TEST FIXTURES ARE CLEANED (1) PRIOR TO ASSEMBLY (2). ASSEMBLY AND TEST ARE PERFORMED IN A CLEAN ROOM (3). LUBRICANTS ARE NOT ALLOWED FOR ASSEMBLY OR TEST (2). COMPONENT LEVEL TEST FLUIDS ARE NITROGEN (4) AND HELIUM (5), WHICH MEET THE HARDWARE CLEANLINESS REQUIREMENTS (1). THE COMPONENT PARTS AND SUBASSEMBLY ARE FREE OF VISIBLE FOREIGN PARTICLES AT THE TIME OF ASSEMBLY (1). THE PISTON SEAL IS MADE FROM GRAPHITE-FILLED TFE TEFLON (6). IT IS USED BECAUSE OF ITS COMBINATION OF LOW COEFFICIENT OF FRICTION AND RESISTANCE TO COLD FLOW (7). THE SEAL AND PISTON (8) SURFACE FINISHES ARE SELECTED FOR DYNAMIC SEALING AND TO PREVENT EXCESSIVE WEAR. THE PISTON IS MADE FROM HEAT TREATED INCONEL 718. INCONEL 718 IS USED FOR ITS STRENGTH, DUCTILITY, RESISTANCE TO CORROSION, AND STRESS CORROSION RESISTANCE (7).

(1) RL10001; (2) RL00460; (3) RQ0711-600; (4) MIL-P-27401 TYPE II; (5) MIL-P-27407; (6) RES1255; (7) RSS-8582; (8) R0019123

FAILURE CAUSE: C: 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, WHERE 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: ALL CAUSES

THE HIGH CYCLE AND LOW CYCLE FATIGUE LIFE OF THE ANTI-FLOOD VALVE MEETS CEI REQUIREMENTS (1). THE MINIMUM FACTORS OF SAFETY FOR THE AFV MEETS CEI REQUIREMENTS (2). THE AFV WAS CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH, SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (3). THE ANTI-FLOOD VALVE SUCCESSFULLY COMPLETED DVS TESTING REQUIREMENTS (4), INCLUDING VIBRATION (5), AND ENDURANCE (6).

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

**SSME FMEA/CIL
INSPECTION AND TEST**

Component Group: Propellant Valves
 CIL Item: D300-03
 Component: Anti-flood Valve
 Part Number: RS007003
 Failure Mode: LOX flow restricted or shutoff.

Prepared: P. Lowrimore
 Approved: T. Nguyen
 Approval Date: 6/30/99
 Change #: 1
 Directive #: CCBD ME3-01-5226

Page: 1 of 2

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	FILTER 100 MICRON RATING		286-5008-001
	FILTER CAPABILITY	FILTERS ARE TESTED AND INSPECTED FOR FLOW, DIRT CAPACITY, CLEANLINESS, AND BUBBLE POINT PER SPECIFICATION REQUIREMENTS. THE FILTER IS CHANGED PRIOR TO EACH FLIGHT. THE OXIDIZER SUPPLY IS FILTERED TO 800-MICRONS BY EXTERNAL TANK FILTERING. THE OXIDIZER CLEANLINESS IS CONTROLLED BY VEHICLE REQUIREMENTS. UPSTREAM COMPONENTS ARE VERIFIED TO BE CLEAN TO OXYGEN SERVICE REQUIREMENTS.	RC256-5008 OMRSD V41B00.220 ICD 13M15000 RL10001
	CAP PISTON SEAL		R0019122 R0019123 RES1255
	COMPONENT CLEANLINESS	COMPONENTS ARE VERIFIED TO BE CLEAN PRIOR TO ASSEMBLY. ASSEMBLY IS VERIFIED TO BE IN A CONTAMINATION CONTROLLED ENVIRONMENT.	RL10001 RQ0711-600
	SEAL INTEGRITY	SEAL MATERIAL IS INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS INCLUDING LOX COMPATIBILITY TESTING. SEALING SURFACES ARE INSPECTED TO DRAWING REQUIREMENTS.	RES1255 RB0130-086 R0019122 R0019123 RES1255
	PISTON MATERIAL INTEGRITY	THE PISTON MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS. PISTON HEAT TREAT IS VERIFIED PER DRAWING REQUIREMENTS. THE PISTON IS PENETRANT INSPECTED AFTER HEAT TREAT AND FINAL MACHINING.	R0019123 RA0115-116
C	SEAT POPPET		R0019127 RS008225
	POPPET AND SEAT INTEGRITY	POPPET AND SEAT MATERIALS ARE VERIFIED PER DRAWING REQUIREMENTS. POPPET AND SEAT ARE PENETRANT INSPECTED AFTER FINAL MACHINING POPPET AND SEAT INTEGRITY IS VERIFIED BY LEAK TESTING DURING PRE-LAUNCH CHECKOUT	RS008225 R0019127 RA0115-116 OMRSD V41B00.100
	ALL CAUSES	ASSEMBLY CLEANLINESS AND FUNCTION ARE VERIFIED PER SPECIFICATION. VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING	RL00460 RL00461
	ASSEMBLY FUNCTIONAL VERIFICATION		
	HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)		

D - 151

Component Group: Propellant Valves
CIL Rem: D300-D3
Component: Anti-flood Valve
Part Number: RS007083
Failure Mode: LOX flow restricted or shutoff.

Prepared: T. Lowitt
Approved: T. Nguyen
Approval Date: 6/30/99
Change #: 1
Directive #: CCBD ME3-01-5226
Page: 2 of 2

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
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
 Component: Anti-flood Valve
 Part Number: RS007083

Prepared: P. Lowmore
 Approved: T. Nguyen
 Approval Date: 6/30/89
 Change #: 1
 Directive #: CCBD ME3-01-5226
 Page: 1 of 1

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			